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THE COMMERCIAL SEA FISHES OF GREAT BRITAIN.

THE EFFECT OF THE EXISTING NATIONAL AND INTERNATIONAL LAWS FOR THE REGULATION AND PROTECTION OF DEEP SEA FISHERIES.

SALMON LEGISLATION IN SCOTLAND.

LONDON
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PRIZE ESSAYS—PART I.

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THE

COMMERCIAL SEA FISHES

OF

GREAT BRITAIN.

NATURÆ DISCERE MORES.—FRANCIS DAY, F.L.S.

THE
COMMERCIAL SEA FISHES
OF
GREAT BRITAIN.

THE natural history of the commercial sea fishes of Great Britain forms a subject which is not only of the greatest importance to the fishermen who capture them, the salesman who disposes of them, the consumers who purchase them, but also to those whose trades are intimately bound up in the prosperity of shipping and fish-curing. Irrespective of the foregoing classes, sea fish are interesting to the general public, for their capture in ages long gone by may be asserted to have been the basis from which commerce has sprung.

Man in his savage condition must have possessed the natural wish of desiring food when he was hungry, and, nauseated with a vegetarian diet, he would seek change by the addition of animal substances. Those residing near the sea coast would first resort to such molluscs, crustacea, and fish as could be readily taken in the shallows or were left in pools by a receding tide. But as man's wants increased, and his sources of supply began to diminish, he would have to add to his devices. He would wade after his prey, pursue them with spears, shoot them with bows and arrows, or obtain them by setting up dams or weirs.

But, unless under peculiar circumstances, the time would arrive when augmented captures would again be necessary, and he would have to venture still further out, to dive after his prey, construct nets, to float on logs or rafts in order to use them in the most advantageous localities, and this would in time lead to the construction of boats, and finally that of a ship. This last would become a necessity as soon as he wished to extend his range to better fishing grounds, or export his spoils to distant markets. Thus the basis of navigation and commerce may reasonably be supposed to have been laid by man pursuing the finny tribes for the purpose of obtaining them as food or conveying them dried or cured as an article of merchandise to transmarine countries.

When we commence our investigation into the commercial sea fishes, the difficulty at once arises as to what plan to pursue. For there exist several distinct paths, each in their way leading to this end, while but few authors have attempted to embrace both the practical and scientific aspects of the enquiry.

The museum naturalist, wrapt up in the contemplation of his alcoholic and stuffed specimens, his skeletons and, perhaps, fossil remains, unless practically acquainted with field work, generally restricts himself to reviewing, and too often condemning, his predecessors' labours, oblivious that at the time they wrote access to information was not so readily attainable as in the present age. His account rarely passes beyond the anatomy and external appearances of fishes, how they breed, grow, and vary, entering perhaps into a short history of the successive appearance of families in different geological eras, and their geographical distribution in the present time, the latter being culled from the works of travellers, assisted possibly by personal research among the ticketed specimens on the shelves of his museum.

The comparative anatomist and embryologist takes another standpoint; considering morphology as the basis of all classification, the fish is examined from its earliest appreciable stage, its changes and its life history come under review. Histology is called into assistance, the microscope and the dissecting knife are the constant accessories of those who have selected this laborious path, one which, perhaps, leads to the most solid results.

The pisciculturist and field-naturalist are often more concerned as to how fishes live and breed, how hybrids occur, and whether such are or are not sterile, the reasons why some forms thrive or the reverse, the causes of migrations, their geographical distribution, the effects of temperature, light or darkness, depths and physical conditions of the water, electrical disturbances and storms, ocean circulation, and also the best modes of transporting the living and conveying the dead; the voracity of fishes, their favourite food, how to capture them with the least injury to the fisheries; and to these have to be conjoined investigations into their faculties of taste, smell, respiration, hearing, the production of sounds, as well as if they emit odour when in the water; their emotion and instincts, whether they sleep, and their amount of sensibility to pain; diseases to which they are subject, or causes of their destruction; the effects on them of injuries; their friends and their enemies; how some seek refuge inside other animals, or use such as affording them means for moving from place to place; how the eyes of some living in dark caverns are deficient, and small in such as usually reside in muddy situations; how their colours vary, and the cause of such; how some living at considerable depths in the sea emit light, and others after life has ceased, but prior to putrefaction having commenced. Lastly, the effects of a fish diet; how injuries are caused by fish; how to form piscina; the result of transporting marine fish to fresh waters, or fresh-water forms to the sea.

In studying fishes in a practical manner, more especially respecting such as are commercially useful to man, it must be evident that the investigations of the pisciculturist must be pushed into subjects which the casual observer would hardly expect. The substances, whether animal or vegetable, upon which fish subsist; the reasons why certain forms restrict themselves to distinct localities; the causes of their abundance, or the reason of their diminution; and this again leads to how inferior organisms are nourished, and what extraneous causes have any effect upon them. Not only, then, have we to investigate the food of fishes, but the nature of their friends, and likewise of their enemies.

If we divide the animal kingdom into the vertebrate and invertebrate forms, we are all aware that fishes, possessing as they do a backbone or vertebral column, belong to the highest of these subdivisions. This includes all animals having a longitudinal axis or spine situated in a superior or dorsal cavity, and one which contains the brain and spinal chord, but is entirely separated from a lower cavity or visceral tube, which represents the condition existing in invertebrata.

The classification of vertebrata now most usually adopted is as follows:—

I. MAMMALIA. Young, born alive (viviparous), and nourished by their mother's milk.

II. SAUROPSIDA. As birds and reptilian forms, that are oviparous or oviviparous; are not mammals, and never possess gills.

III. ICHTHYOPSIDA. Such as batrachians and fish, also oviparous or oviviparous, but in all of which gills exist during some period of their existence.

Speaking generally, fishes are *vertebrate animals, adapted for an aquatic life, having their extremities modified into fins. They breathe (except in some few and mostly tropical forms) through the medium of water, solely by means of their gills. They are cold blooded, their heart having merely two cavities. Some possess scales, others are destitute of them, or else they may be modified into bony plates.*

The fishes which exist in our seas may be divided into the following sub-classes, omitting the Cyclostomata (Lampreys):—

I. TELEOSTEAN or bony forms, likewise termed "true fishes," and in which the skeleton is bony and the vertebræ separated one from another, the posterior ones being bony or covered with osseous plates. The branchiæ are free, the bulb of the aorta having simply two valves at its origin.

II. CHONDROPTERYGIAN or cartilaginous forms, with no cranial sutures, the gills attached by their outer edges to the skin (see note, p. 314).

There are two orders among the cartilaginous fishes—(1.) *Ganoidei*, having merely one external gill-opening, and a rudimentary gill cover, as sturgeons. (2.) *Plagiostomata*, having from five to seven external gill-openings and no gill cover; this latter order being subdivisible into (*a*) sharks, wherein the trunk gradually passes into the tail, and (*b*) skates and rays with a ventral gill-opening.

If we look at the external appearance of a bony or teleostean fish, as a carp or gurnard, we see a comparatively large head, attached to the trunk without the intervention of a neck; the body tapers off towards the posterior extremity, and the sides are somewhat flattened. As irregularities would impede progress through the water, a fish's sides are generally smooth, and often covered with scales, which will be considered further on.

A fish, such as a carp, is provided with fins for locomotion, and has the vertical ones in three principal situations, and unpaired: the back or *dorsal* fin, which may be subdivided into two or three; one at the end of the tail or the *caudal;* and one, which may be subdivided into two or more, behind the vent, termed the *anal.* There also exist paired fins, one pair in the region of the breast or *pectoral,* corresponding with the anterior extremities of the higher vertebrates; while a second or *ventral* pair represent the legs or hind limbs. The dorsal and anal fins increase the extent of the lateral surface of the fish, by which means they act as a check against lateral oscillations, or a tendency to turn belly up. If these fins are removed, the fish reels about first to one side and then to the other. The caudal assist the velocity with which a fish is proceeding, and this is most apparent in such as have this fin forked. The pectoral is extended from the body, will act like a rudder, and turn the body in a curve towards that side. The ventrals being horizontal, serve to balance the body, and when only one fin acts to incline it to one side, while the two being in motion together can elevate or depress the fish.

If we examine the composition of these fins, we find in the bony fishes two distinct forms of rays—the one being spinate, consisting of spines destitute of any transverse articulations, and with a hard and sharp extremity; the other being softer, and composed of numerous pieces articulated together and possessing a similar soft extremity.

But though we can assert that as a rule fins are composed of spines, rays, and an inter-spinous or inter-radial membrane, we observe many modifications, some taking on a distinctly osseous character, as in the sheat or scaleless fishes, in which the first ray of the dorsal fin and the upper one of the pectoral are frequently seen as bony spines.

The component parts of a fin may also become strangely altered, so that it becomes widely different from what is seen in a typical carp or perch. Thus the flying fish, *Exocœtus*, has its pectorals modified into an organ or parachute for assisting it to pass through the air; our little stickle-backs, *Gasterostens*, have each ventral fin in the form of a single spine, useful for offensive or defensive purposes, as we perceive in the more developed unicorn fish, *Triacanthus*, of the Eastern seas. The gurnards, *Trigla*, have some of their pectoral rays developed into a locomotive and tactile apparatus. In the angler, *Lophius*, the whole of the fin can be employed as an organ for locomotion. In a few fresh-water loaches the upper pectoral ray becomes osseous, its extremity becomes flattened and spatulate, enabling it to be employed as a species of spade, so that on the approach of danger it can dig down into the sand and conceal itself with great rapidity.

Curiously as we see the many modifications of the fins, no less extraordinary are the forms of some of their bodies; examples exist in the globe-fish, *Tetrodon*, the flattened sole or flounder, the elongated pipe-fish, or the sword-fish, *Xiphias*, with its snout modified into a powerful weapon of offence.

The value of the skin or tegumentary covering of animals as a means of resistance against external injuries, becomes increased should hard substances enter into its composition, and for this purpose many fish are furnished with scales. Scales are developed on papillæ on the deep layer of the skin or corium, which, increasing by successive accretions, passes somewhat obliquely between it and the upper layer or epidermis. The basal portion of the scale consists of mostly somewhat gristly laminæ, while calcification is developed from the upper layer of the dermis; consequently both the upper and lower layers of the skin assist in the formation of scales. We find that scales may take on many characters, as denticles in the sharks, osseous plates in sturgeons; while in bony fishes they may either degenerate or give rise to structures which are very dissimilar to typical scales, as seen in the plates and spines of the plectognaths and pipe-fishes or Lophobranchii.

Scales may either overlap, when they are said to be imbricate, or they may be at a greater or less distance apart. The most common forms of scales have received distinctive names; those which are more or less flexible and have a spinate outer margin, as seen in the perch, are termed *ctenoid*, or comb-like; those in which the edges are smooth, are known as *cycloid*, or circle-edged, as found in carps. The second division of scales are as hard as teeth, due to the predominance of bone earth, and consist of the *ganoid*, which somewhat resemble the eve-tiles of a house, and the *placoid*, or such as are provided with a spine. Although it is frequently highly desirable to ascertain whether a fish has cycloid or ctenoid scales, still there are many instances in which they do not appear to be correlated to any important functions. Thus among the gobies some have ctenoid, others cycloid scales; or both forms may exist on the same fish, or even scales may be entirely absent, and all these variations occur within the limits of a single genus.

External colours in fish are often due to the influence of light, while the tints even in the same species are found to vary considerably in different localities, or when under peculiar forms of diet. In some the colours may be due to the character of the water they inhabit, for if the latter is opaque and muddy, its finny inhabitants are found to be darker than are those obtained from localities where it is clear; in running streams they are generally lighter and brighter than when from stagnant pools, and the same difference may be observed between such as are taken in the open sea or along a muddy coast.

Age and season likewise exercise an influence in this respect, as well as the health of the fish and temporary emotions. In the very young, one sees but few markings or colours, but these rapidly develop themselves, and by the time, or even before, the first breeding season has been reached, the brilliancy of the individual has often attained to its maximum. Many see in these markings grounds for assuming the probability of the descent of many forms from some common ancestor; thus vertical bands are almost invariably among the young of all the salmonidæ, as well as in most of the marine scombresocidæ, in which they are generally diagnostic of the immaturity of the individual. Large spots or blotches, especially when surrounded by a light ring, are likewise good reasons for supposing that the individual has not attained its full size. In some forms longitudinal bands become modified, two narrow ones taking the place of a single wide one, or they may be broken up into blotches. Some fish, which are of a simple silvery colour in one place, are spotted in another, and others which have no marks on their bodies throughout their lives frequently have the colour of their fins varying with age.

There appear to be at least two modes in which variations in colour occur—the first due to the interference of light produced by the presence of thin plates; and secondly, those due to anatomical elements frequently highly coloured and endowed with sarcodic movements, capable of marked changes of form under special influences, so as to present the shape of extended dendritic surfaces, or minute spherical masses, through which the pigment is distributed. The changes of colour due to thin plates are of course exceedingly variable, the tints following each other with great rapidity according to the angle at which we view them. Such is seen among insects, crustacea, and some families of fishes, as those of the dolphin, *Coryphæna ;* while the second class of colours, those due to the movements of the anatomical elements, are directly connected with the impression of colour received by the eye, and brought about by the reflex action of the nervous system (Agassiz).

Due to certain causes, fish may assume colours which are not natural to the species, as black, when it is termed melanism, red, known as erythrism, yellow or leucœthiopism, these varieties being most common in fresh-water forms. There is also a piebald or white form, albinoism, very common in flat fishes, which is probably more or less hereditary, and may have been originally due among pleuronectoids to a right and a left variety breeding together.

Another external phenomenon sometimes observed among marine fishes is a luminous appearance, perceived either when the creature was alive or soon after death. The shark is one of the former which has the reputation of being luminous, the light being reputed to proceed from its abdominal surface. Shoals of fish frequently emit flashes of light, visible at great distances, and often due to the collision of the fish with minute light-producing animals. We also find a general luminosity which exists for some time in a dead fish, commencing a short time subsequent to death and continuing until decomposition sets in. In ch forms as decompose more rapidly, luminosity is most quickly developed, especially in summer, and when placed in a warm and damp place; this is well seen in members of the cod family.

There are certain marine fishes, as *Argyropelecus*, *Maurolicus*, &c., which possess luminous organs of a circular form, some resembling impressions and other slight prominences of the skin. A form not uncommon on the east coast of Scotland is the "pearl-sides" of Yarrell, *Maurolicus Pennantii*, having those brilliant spots along the entire length of the abdomen, and even seen on the head. A few years since it was advanced that among these fishes were two kinds of metameric organs, the lenticular and the glandular. Professor Reinhardt was so fortunate as to obtain in the mid-Atlantic two examples of fishes thus provided, and although they merely lived a few minutes after removal from the net, he ascertained with certainty that a light radiated from a spot in the head, flashing, as it were, from thence along the back as far as the first dorsal fin.

As our knowledge of the forms of animal life which exist at great depths in the ocean has been much increased of late years, a theory has sprang up that the only light existing at these abyssal depths must be derived from the evolution of light from animals, for at these depths fishes are found which are furnished with very large eyes, as if to collect every ray of light which might be present in their vicinity.

If the exterior of fishes excites our wonder and stimulates investigation, no less a field is there in which to extend our inquiries than their internal structure, which, however, I must very briefly, and in a cursory manner, enter upon.

If we examine the intestinal tract of fishes, we must commence at the anterior end of this canal or mouth, the common receptacle of water passing to the gills for respiration, and food transmitted to the stomach for nutrition; while, as might be anticipated, its capacity is large and variously formed. But the several purposes to which the mouth is employed, and the means by which such are effected, it is not my purpose to enter upon, except to remark on the absence of the salivary glands, which in some forms appear to be represented by some mucous follicles that open into the mouth below the side of the tongue, much saliva doubtless being unnecessary, owing to the moist condition of the food. Teeth are of various forms and differently disposed in the different families and genera, in fact, more especially in the osseous forms, there is a tendency for the mucous membrane in almost any part of the mouth, throat, or gills, to develop teeth. The gastric portion of the intestinal canal consists of an œsophagus and a stomach, between which a cardiac constriction is not so frequently observable as a more or less abrupt change in the structure of the lining mucous membrane. In some forms at the lower end of the stomach and the commencement of the small intestines, a constriction occurs termed the pylorus. It must be observed that the orifices of the two ends of the stomach are usually in bony fishes more or less approximating, in order that the food may be retained as in a cæcum. Occasionally the stomach is situated not in the direct course, but to one side, as it were, of the intestinal canal. Another constriction, marked internally by a more or less well-defined internal valve, shows where the small intestines terminate and the large ones begin.

Should the intestinal canal be slit up, and its inner surface examined, the commencement of the stomach is generally observed to be defined by increased vascularity, and a more delicate lining membrane than that existing in the œsophagus. Its upper or cardiac orifice is usually larger than its lower or pyloric one, while the form of the entire organ is subject to considerable modifications, being usually found in one of the two following divisions: the *siphonal*, which somewhat resembles a bent tube, as seen in the lumpsucker, flounder, &c., and most of the plagiostomes; and the *cæcal*, in which it ends in a blind sac, and the pyloric portion is continued from the right side, as seen in the perch, gurnard, weever, &c. An intermediate or transitional form sometimes is present, as in the sea-scorpion and in the turbot. Irrespective of the foregoing, certain other deviations occur which it is not my purpose entering upon, as in the mullet, wherein the muscular walls are thickened, causing it somewhat to resemble the gizzard of a bird, &c.

Through the pyloric orifice partly digested food reaches the commencement of the small intestines, and we usually find that the distance from the pylorus to the vent is comparatively shorter in fishes than in most of the higher vertebrata. The length of the intestines differs in different classes of fish, and the intestinal lining membrane may be raised into transverse folds as in the salmon, thus increasing the extent of its secreting or absorbing surface, and which is still further augmented by the secretions of numerous cæcal appendages. In other forms we find the intestines themselves convoluted, thus increasing their length as in the carp. The large intestine may be straight, as seen in the sturgeon or chimæra, in which the transverse folds (as observed existing in the salmon) become continuous, and an uninterrupted spiral valve is formed, while the same structure is likewise present in sharks, rays, and their allies, but which may be modified into transverse coils.

It is thus that in fishes economy of spaçe is effected by an increase of the secreting and absorbing surface of the vasculo-mucous membrane lining the intestinal tract, whether such be merely raised into puckers, or those puckers be continued into transverse folds, or even forming a circular, uninterrupted spiral valve or coil to the large intestines.

In many fishes we find what are termed cæcal or pyloric appendages, situated at the commencement of the small intestines. Some have held these appendages to be lateral prolongations of the intestine, which pour out a secretion similar to that of the intestinal mucous membrane. Others consider them as a modified form of pancreas, notwithstanding that a rudimentary pancreatic gland has been detected in the form of a minute glandular body, terminating in a duct, which opens by from one to three orifices into the intestines close to the bile duct. It is seen both in fishes which possess pyloric appendages, as the perch, cod, salmon, and sturgeon, as well as in such as are deficient in them, as the brama, gar-pike, and pike, while the sharks and rays are furnished with a reddish-yellow and lobulated gland, which is more similar to what is perceived in the higher forms of vertebrate animals.

In osseous fishes these pancreatic ducts are seen as one or more small tubes, each ending externally in a blind extremity. They either surround the commencement of the small intestine, or spring from one of its sides in the first portion of its course, and each opening internally into it. A single fish may possess from one to a hundred or more of these appendages. In the sword-fish (*Xiphias)* all the various tubes conjoin. In the sturgeon (*Acipenser*) a mass of areolar tissue binds the various cæca together, forming it into a pa enchymatous conglomerate gland.

Taking a general survey of fishes, we find that cæcal appendages are far more common among marine than fresh-water fishes, and that in the sharks and rays instead of these appendages a spiral valve, already described, exists in their intestines.

We find members of the cod family, which are more or less ground-feeders, have large numbers of cæcal appendages; so have also the surface-swimming herrings, while the slow-moving flat-fishes (*Pleuronectidæ*) possess very few. But the sluggish dory (*Zeus*) and the slow-swimming lumpsucker (*Cyclopterus*) have many, and such variations in forms which have somewhat similar habits is by no means uncommon. Thus in some species of sea-perches (*Serrani*) living in the same localities, the number of these appendages may vary from eight to fifty. That a rich or augmented diet may increase the number of these appendages has been proved by sending out trout to Tasmania, where they have, due to good living, grown to a size not attained in this country by their ancestors, while the number of cæcal appendages has increased, showing that these appendages are inconstant as to their numbers.

The air- or swim-bladder, likewise termed the air-sac or air-vessel, is a single or variously sub-divided sac, or it may be two sacs partially or completely separated one from the other. Situated above the centre of gravity, it lies beneath the vertebral column or backbone, from which it is more or less divided by the kidneys, while inferiorly the peritoneum is between it and the intestines. As this organ is entirely absent, or ceases to be developed, in many fishes, and may be present or wanting in species belonging to the same genus, it would appear that it is not indispensable to the existence of these animals, its functions being accessory or supplemental, under certain conditions, to those of other organs of the body, while it is generally observed that the urinary bladder is largest in those forms in which the air-bladder is absent.

In the embryo it originates as a bud or offshoot from the upper portion of the alimentary canal, or even from the stomach; this offshoot next elongates into a blind tube, which enlarges at its terminal extremity into what will eventually form the air-bladder. Consequently at some period of a fish's existence there must of necessity be a tube connecting the air-bladder (where one exists) with the alimentary canal, into which latter it opens usually on its superior or dorsal, rarely on its lateral, and occasionally on its inferior or ventral wall.

Among the bony fishes the air-bladder is present, either as a closed sac (*Physoclisti*), in which communication between that organ and the alimentary canal has been cut off, the majority of which are marine; whereas in such as the communicating duct remains patent (*Physostomi*), the largest proportion live in fresh water. Also, as a general rule, the air-bladder is more usually present in fresh-water than in marine genera.

It has long been known that the gas contained in the air-bladder is a mixture of oxygen, azote, and carbonic acid, in variable proportions, in accordance with species, or even with individuals; while after death this organ is generally found distended with gas, consisting chiefly of nitrogen in the fresh-water forms and oxygen in the marine. It has formed a subject of considerable discussion as to how this gas is generated, but as in those forms in which the air-bladder is a closed sac (*Physoclisti*), it is as well seen as in others possessing a pneumatic tube (*Physostomi*), one cannot resist believing that the gas must be eliminated from the blood-vessels lining the interior of the organ.

The air-bladder has usually two coats—an external fibrous, tough, and glistening, and an internal vascular and mucous one. Between these two coats is often seen (especially in the Physoclisti) a red glandular body, most frequently in its inferior region, and compared by some anatomists to the thymus. This gland appears to have the character of a *rete mirabile*, consisting of a double plexus of arteries and veins. Perhaps it may serve the purpose of removing superfluous gas or any deleterious substance, while the pneumatic tube may possibly not be employed to admit air, but acts as a safety-valve when the organ is too tightly distended.

The air-bladder must be refused the title of "lung" in most fishes, because it is usually supplied with blood from the adjacent arteries of the body, not direct from the heart, and returns venous blood into the general circulation. It is, however, homologous with the lung in its position and function in some of the higher orders; and as a gradation can be traced, it becomes no less clear that this homology (leaving its functions out of consideration) exists throughout every variety and condition of air-bladder in the piscine tribes.

The air-bladder is not only absent in many families of fishes, but may be present or deficient among species of the same genus. The common form of British mackerel (*Scomber scomber*) does not possess it, but it is present in the rarer Spanish mackerel (*S. colias*), also found in our seas. In such forms as swim near the surface, it is generally of comparatively a small size, while in some of those which live near the bottom, as flat fishes, it is absent. In species possessing this organ, should it become ruptured from any cause, permitting the contained gas to escape, the fish sinks to the bottom. On the other hand, some forms which have been hooked or netted at great depths, and suddenly brought to the surface without having had time to compress or partially empty their air-bladders, the contained gas being no longer weighted down by a mass of super-imposed water, expands rapidly, causing the organ to burst, or else forces the stomach and upper portion of the alimentary canal out of the fish's mouth.

The chief uses of this organ in teleostean or bony fishes are two: (1) a *hydrostatic*, or for flotation, which serves, by contracting or distending its capacity, to condense or rarify the contained gases, giving it the mechanical function of enabling its possessor to maintain a desired level in the water, and which is accompanied with the power of renewing, expelling, compressing, or dilating its gaseous contents, so that it can rise or fall as necessity occurs. (2) The second use is *acoustic*, it being partially or entirely employed in hearing, by means of various modes of connection with the internal ear, mostly by tubular prolongations of the air-bladder to the internal ear, or by a connecting chain of auditory ossicles.

If we examine the *Physostomi* we find that, as regards the air-bladder, they hold a place between the Physoclisti on one hand, and the Dipnoids and Ganoids on the other. If we examine the carps, *Cyprinidæ*, the *Characinidæ*, and likewise the sheat-fishes, *Siluridæ*, we find that a chain of auditory ossicles connects the air-bladder with the internal ear (instead of a tube filled with gas and a prolongation of the air-bladder as found in Physoclisti). Among the carps we find in the ground-feeding loach a curious modification of this organ; its posterior two-thirds, or its hydrostatic portion, are deficient, the air-bladder being in the form of two rounded lobes, placed side by side, beneath the bodies of some of the anterior vertebræ, and where they are almost entirely enclosed in bone. The pneumatic tube, however, is still found to exist. Passing on to the sheatfishes, *Siluridæ*, we find the air-bladder remarkably modified, in the majority of instances being apparently more useful for acoustic than for hydrostatic purposes. They lead the life of ground-feeders, and the power of employing their air-bladder as a float appears to be subservient to that of hearing. In the marine forms it has thickened walls and the parapophyses of the first vertebræ (ex. *Arius subrostratus*) form expanded plates, to the under surface of which this organ is attached. But in the more inland forms the air-bladder is more or less enveloped in bone, until it becomes as I have described it as existing in the loaches (*Nemacheilus*). The chain of auditory ossicles connecting the air-bladder with the internal ear is confined, so far as I am aware, to the fresh-water Cyprinidæ, Characinidæ, and to the Siluridæ.

Among the marine physostomous forms, the communication between the internal ear and the air-bladder exists by means of cæcal prolongations from the air-bladder, and not by auditory ossicles. Due possibly to the absence of ears, many of our fishermen have denied the sense of hearing to fishes, which they would probably not do were they aware of the existence of an internal auditory apparatus in this class of animals. We find a membranous labyrinth, consisting of a vestibule which dilates into one or more sacculi, separated by a narrow canal from the "alvens communis," and containing two or more auditory ossicles or otoliths, which consist of carbonate of lime, besides which it has a fluid or "endolymph." There are likewise present the three semicircular canals. A true tympanum and membrane, as well as a cochlea, are absent. Now it is hardly to be supposed that this intricate auditory apparatus exists without a purpose. As vibrations in the atmosphere occasion sound, so likewise do they in the water, their force being communicated to the sides of the body of the fish, and on to the internal ear, either assisted or not by the air-bladder. Lacépède relates how some fish which had been kept in the basin of the Tuileries for upwards of a century would come when they were called by their names; while in many parts of Germany, trout, carp, and tench were summoned to their food by the ringing of a bell. Ellis, in his 'Polynesian Researches,' speaks of a native chief of the island of Hawaii, who had brought eels to that degree of tameness that he was able to call them from their retreat with the shrill sound of a whistle. At many temples in India fishes are summoned to receive food by ringing bells or musical sounds. Carew, in Cornwall, called his grey mullet together by making a noise like chopping with a cleaver, and Sir Joseph Banks collected his fish by means of sounding a bell.

The respiration of fishes is essentially the same as in the higher vertebrata; the blood is decarbonised at the gills by absorbing the oxygen contained in the air which is in solution in the water. It may be carried on in more than one manner in a fish at the same time; thus in some tropical countries this function in certain amphibious forms is more completely effected by means of taking in atmospheric air direct, the gills being insufficient to depurate the blood, which is consequently affected by accessory breathing organs (as in the climbing perch, the snake-headed or the scorpion-fishes of India); while M. Jobert has ascertained that in the *Callichthys* this accessory respiratory action is performed by air passing through the intestines. And all who keep fish in an aquarium are aware how, when the water becomes foul or over a certain temperature, the contained fishes rise to the surface and gulp down air direct.

The respiratory current enters the mouth and is normally discharged through the gill-openings, or by orifices situated on either side of the head. But in embryonic and very young forms a different plan may be pursued. In sharks and their allies, wherein the gills are inside and attached to the skin, a difficulty might arise—sufficient oxygenation might not be possible. To obviate this, there are temporary external gills which are constantly bathed in the surrounding fluid. To a certain extent the same plan is likewise adopted in the bony fishes, as in the very young the gill-covers do not cover the gills, which are consequently immersed in the surrounding water and are thus essentially external.

The wider the gill-opening in a fish, the sooner, as a general rule, does it expire after removal from its native element; examples of which may be seen in the herring, pilchard, shad and mackerel. On the other hand, those with narrow gill-openings usually live some time after their removal from the water, as seen in the common eel. For as the delicate fringes of the gills dry, they adhere one to another, and this prevents their acting; consequently, blood cannot be decarbonised. Similarly fish may be suffocated in very muddy water, their gills becoming choked.

Fishes possess two eyes, placed symmetrically one on either side of the head, and which are undoubtedly large if compared with what obtains in other vertebrates, or even in comparison with the extent of surface in their own bodies. Their size, however, is modified in accordance with local surroundings and their habits. Some frequent muddy waters, where vision would be of less service than tactile organs; in such instances appendages for feeling, as barbels, are more developed than eyes. Others, again, are restricted to living in waters in dark caves, where rays of light hardly enter. Irrespective of the foregoing instances where atrophy occurs, there are many forms residing in the dismal abysses of the ocean where solar light is unable to penetrate. Another modifying influence is, whether the habits of the fish are diurnal or nocturnal, the latter, unless residing in dark places, requiring the largest organs of vision.

The eyes of fishes are mostly situated in orbital cavities, where they rest upon a cushion of adipose or gelatinous substance. Their direction is subject to considerable variation, for, although usually placed laterally, as in the perch, they are not invariably so. The angler (*Lophius*) has them on almost the upper surface of the head; the hammer-headed shark (*Zygæna*) has the sides of the head laterally prolonged, at the extreme edges of which the eyes are placed. The blennies appear to observe objects as well with their heads out of the water as when submerged in the sea, and they move their eyes independently one of the other. In the sun-fishes (*Orthagoriscus*) there exists a circular palpebral fold provided with a sphincter; while some sharks have a nictitating membrane. Among the flat fishes are remarkable modifications, which I have alluded to when treating of the species.

I do not propose giving a description of the globe of the eye and its various membranes, but simply to note a few deviations from what commonly occurs. The sclerotic is even found bony in some well-ossified forms; the cornea is nearly flat. The iris is a thin contractile curtain situated behind the transparent cornea and suspended in the aquecus humour; its dilating and contractile powers are not very extensive. Its centre is perforated by the pupil, for the transmission of light to the interior of the eye. The pupil is mostly circular, but in some forms is vertically or horizontally elliptical, as in the majority of sharks, or it may even be almost quadrangular, as in *Galeus*. Occasionally a veil or flap descends from the edge of the iris at the upper portion of the pupil, as may be seen in some pleuronectoids, as in the turbot, or in a few of the rays of our seas, as the Homelyn, wherein this process is somewhat similar to the shape of a vine-leaf, surrounded by twelve short projections. These forms live more or less at the bottom of the sea, and to them a large amount of light is evidently unsuited; they are consequently provided with an extensible and retractile veil, capable of regulating, or even entirely preventing rays entering from above.

The aqueous humour in the anterior chamber is very small in amount, while the vitreous body which fills up the greater portion of the ball of the eye is of firmer consistence than in other vertebrate animals. The crystalline lens is nearly or quite spherical.

Fishes' eyes present a great variety as well as extent of outer coverings, some portions of which are opaque and others transparent. The skin which covers the eye is commonly thin in substance and transparent in character, being modified in order to suit altered conditions. In some forms, as in the mackerel, what are usually termed "adipose lids" are present on either side of the eye, and covering a portion of its ball. These lids are formed by a single layer of skin having been continued from contiguous parts of the head, over the front of the eye, but bulging anteriorly and posteriorly; these bulging on loose portions become a double fold, between the layers of which fat may be found. Or a double layer of skin may pass entirely across the eye, as in the blind or bib. In the snipe-fish (*Centriscus*), one example of which has been captured in this country, some minute scales are present upon the outer fourth of the skin covering the globe of the eye, except in its anterior portion, probably for its protection against direct injuries. Some forms have a sort of almost fixed eyelid along the upper portion of the eye, consisting of thickened and coloured skin, in which scales are often present, as in the sting-fish (*Trachinus*). This opaque upper lid, evidently used as a protection, is found in some flat fishes. In the turbot, not only does this thick skin cover its upper and lateral portions, but, being insufficient to protect the eye from the irritation of the sand in which it hides itself, it is able to elevate a thick lower eyelid or else to depress the transparent portion of the globe of the eye below this fold of skin.

Doubtless the foregoing modifications of fishes' eyes might be largely increased, and many more illustrations given, but I think they are sufficient for the purpose of pointing out that the skin which passes across this organ may be employed as a protection when it is scaled, coloured, thickened, or even transparent.

Fishes are provided with organs of smell, which enable them to receive impressions from the surrounding medium, direct them to their food, or warn them against impurities. These organs are placed much as in the higher animals, but (except in the *Cyclostomata*) with this difference, that they never communicate with the mouth, or are related to the function of breathing, for were their delicate lining membrane subject to incessant contact with currents of water, such would doubtless occasion deleterious results. The nostrils are depressions or cavities, lined with a large and highly vascular pituitary membrane, packed into as small a compass as possible, while there are generally one or two external openings situated on the snout. The capsule which lines those depressions is formed of a fibrous membrane, and which lies upon a cartilaginous or osseous base termed the turbinal bones.

The appearance of these openings or nostrils in bony fishes is various; generally two, and the anterior one often tubular, the posterior more frequently oval, while a bridge of integument occasionally provided with a valve, or a wide interspace may exist between the two nostrils, which internally communicate with each other. In some eels, and a few other bony fishes, one of the nasal orifices is on the side of the upper lip.

Among the plagiostomes the nasal depressions are very large, and a membranous opercle is present by which they may be closed; the opening is on the under surface of the face. The membrane lining them is very vascular, and provided with crypts which secrete mucus. As the nasal cartilage is provided with certain muscles, it has been concluded that these fishes scent as well as smell, that is, that they actively search for odoriferous impressions by rapidly changing the current of water through the olfactory sac.

In the *Cyclostomata* there is a single nasal aperture situated at the upper surface of the head; in one form, the myxine, or "hag," a communication with the palate exists in the form of a naso-palatine canal, which opens backwards on the palate, where it is provided with a valve. In the stonesucker or lamprey (*Petromyzon*), the nasal duct terminates in a blind pouch, and does not perforate the palate. The organs of smell are supplied by the olfactory nerve and a sensitive branch of the fifth pair.

That fishes smell has long been known, and in olden times anglers employed certain essential oils to add zest to their baits. At Borton Cliff, near Shrewsbury, a gentleman was in the habit of feeding a trout, which lived in a stream at the bottom of his garden, with caterpillars. If he took them up in his fingers the fish invariably refused to swallow them; at first it seized its prey, next rejected it, and then dashed away. If the caterpillars were knocked off the bushes into a leaf and shaken into the stream, the fish at once swallowed them. Possibly the reason why we find blind fish so constantly in good condition is due to their obtaining their prey by means of their sense of smell, conjoined, perhaps, with that of touch. Trout will ascend up stream hundreds of yards to paste made of salmon roe, which would seem to be due either to smell, taste, or a combination of the two.

The sense of taste in fishes is generally considered to be but little developed, no tongue or organisation of soft parts being present. Still, it cannot be supposed that this class of animals are insensible to preferring some kinds of food in preference to others, for such an idea almost every angler would refuse to entertain. In the sturgeon, the glosso-pharyngeal nerve sends branches to the branchial arches and palate, where probably the sense of taste resides; while it has been advanced that peculiar organs well supplied with nerves are developed in similar localities in carps.

As special organs of touch, we find barbels more or less developed around the mouths of some fishes, especially the sheat-fishes or siluroids, which mostly live in muddy waters, and must mainly obtain their food through the faculties of smell or touch. These organs are likewise more or less seen in carp. Irrespective of barbels, the fin rays may be employed for tactile purposes, as is especially observable in the free pectoral rays of the gurnard.

Various causes may be in existence hastening or retarding the growth of marine fishes, as the purity or the reverse of the water in which they reside, its temperature, saltness, the strength of the prevailing currents, the force of the waves, the character of the neighbouring coast, if it is bold and rocky, fertile or barren, and whether the shore is sandy or stony, while some of the most suitable places for growth are found in marine banks well stocked with invertebrate forms of animal life. Confinement, as in aquarium, in many species seems to decrease the rapidity of growth, but in some forms, as turbot and conger, such does not appear to be invariably the case. In the Southport Aquarium, some small turbot, measuring about 3 inches across, attained to 10 lbs. weight in two and a half years, and 20 lbs. after another two years, or a yearly increment of about 4½ lbs. a fish.

The voracity of some forms is well known. Thus the skeleton of an angler-fish (*Lophius*) was exhibited before the Dublin Zoological Society in 1847. It was 2¼ feet long. Inside its stomach was found a cod 2 feet long; inside the cod were two whiting of the ordinary size, and within each whiting were the half-digested remains of numerous minute fishes.

The angler-fish crouches in the sand, stirring up the mud by the action of its ventral and pectoral fins. Hidden by this obscurity, it elevates an appendage situated on the upper surface of its head, and waves it in various directions by way of attraction as a bait, and small fishes which approach are at once seized as a prey. The weever (*Trachinus*) strikes with its opercular spine. The torpedo, commonly known as the cramp-fish, evidently employs its electric organ for the purpose of securing fast-swimming fish, which would otherwise readily outswim it. Some valuable forms of fish are found to depend on food liable to injury or destruction, while other and equally suitable forms subsist on food which is inexhaustible in amount. Some feed on insects which fall into the water, some are herbivorous, some carnivorous, and many omnivorous. Many forms of fish cease, or almost cease, feeding during the breeding season, but this is not invariable. Also during the cold season of the year the desire for food appears generally to be little developed.

Some forms survive after very considerable injuries. Thus in the Weston-super-Mare Museum is the cast of a sword-fish which had evidently been impaled by one of its own species, but recovered. A few years since, some fishermen obtained a sturgeon off Margate, and, having attached a rope round it a little above the tail fin, they towed it up the Thames, intending to dispose of it to an aquarium. On arrival the rope was found to have cut down to the backbone, and the fish was refused under the belief it could not live. The fishermen pleaded for its being tried in the aquarium, and it entirely recovered. Many instances might be adduced tending to show that this class of animals is not very sensitive to pain; but I will merely allude to the numerous instances in which fish, having been hooked and escaped, have in a very short period again taken a bait. While we are informed of an angler who, having hooked a small perch, foul, occasioning its eye to be torn out, threw the fish again into the pond, but left its eye on his hook as a bait, when, curiously enough, the injured fish was very shortly again secured in attempting to seize its own eye.

It seems very probable that fish have some means of intercommunication, and instances have been adduced when h-water forms have evidently warned their friends against certain kinds of baits, but how they did so is difficult to determine.

Voluntary and involuntary sounds, due to emotions, are emitted in different manners by many fishes, and in some rare instances solely at certain seasons. Very dissimilar organs may originate somewhat similar sounds, while apparently identical ones may not always be expressive of the same feeling. Some sounds are perceived on fish being removed from hooks and thrown into a basket. These may be temporary, mostly involuntary, and often convulsive; or their production may be due to unusual movements of the jaws, opercles, or other bony elements; or else induced in thick-lipped forms when compelled to suddenly open their mouths. There are likewise voluntary sounds, such as constant ones, always produced by the same organ, and which are evidently intentional, sometimes even being characteristic of a species; as a harsh grating sound as of stridulation, caused by the friction of the dental organs, or some bones, as the pharyngeals, which guard the entrance into the gullet. Then there are blowing sounds, as noticed in the carp tribe and among the siluroids, which have been attributed to the expulsion of gas from the air-bladder; musical sounds caused by the contraction of muscles, which are contiguous to the air-bladder, so that the latter acts as a kind of sounding-board; and purring sounds as made by the maigre.

Many instances are on record of fishes showing affection one to another, and pining away when separated, but recovering on being again brought together. So also they show unmistakeable proofs of anger, as may be seen in sticklebacks (*Gasterostens*), which fight for the possession of some denied corner of an aquarium, when one being defeated the conqueror becomes more gorgeous in his hues.

Spiny-rayed fish under the influence of anger or fear at once erect their spiny rays, or even if unable to escape in any other way have been known to attack their would-be captor with their teeth. Fear is very apparent among some marine forms of fishes. Porpoises and whales have been observed to drive large schools of herrings and pilchards up estuaries, inside coves, or even direct upon the sea-beach.

Wounds inflicted by fish may be poisonous, or so intensely irritating, that it becomes difficult to decide whether such is or is not due to the presence of venom. Wounds may be inflicted and severe, due to the presence of a highly irritating substance existing on the surface of the spine by which the injury has been inflicted, or else by a distinct venom secreted by the fish, and ejected into the wound. Or a jagged wound may be caused into which irritating substance has been drawn by a toothed spine. Among bony fishes it is not unusual for transient poisonous effects to be produced from the puncture of a smooth-spined fin ray, perhaps due to the property of the mucus which is usually present. Some fish evidently secrete a venom, and discharge it into a wound. This is effected by spinous fin rays or spines situated on the head. (*See* weever fish, p. 79.)

Fishes are diœcious, the sexes being normally found in different individuals ; in exceptional instances hermaphrodites have been detected. Some forms are monogamous, but the majority are polygamous, while the females are usually more numerous than the males. In the sharks and rays a congress occurs between the two sexes, and the arrangement of the sexual organs is somewhat similar to what obtains among the higher vertebrata. The ova, which are few, are fertilised while still contained within the oviduct, and the development of the young is almost completed before it emerges from its parent. In a few forms the young are produced alive. In the hags and lampreys the arrangement is still more simple, the ova when set free descending into the abdominal cavity, and finding its exit at the abdominal pore situated behind the vent.

In the teleostean or bony fishes we find considerable differences in the form of the male organs, but all have one phenomenon in common, which is a great seasonal augmentation in size in such as are not sterile. This, when arrived at maturity, is commonly known as "soft roe" or "milt." Some fishes, although they have not attained anything like adult size, are capable of the reproductive process, the milt being fully developed in the male parr, while the female of the same age is usually incapable of propagating its kind, as less nourishment appears to suffice for the production of milt than is necessary to form ova. Without entering upon the different forms in which these organs exist, it will suffice to remark that when "vasa deferentia" are absent in the males, oviducts are similarly wanting in the females. When the testis is single so is the ovary. In most osseous fishes the ovaries form two elongated sacs, closed anteriorly, but posteriorly continued into a short and wide oviduct, that terminates behind the vent, and mostly before the urethra. The inside of these sacs is more or less lined with the "stroma," or a peculiar tissue within which the ova are developed. In forms in which the ova are hatched before extrusion, the stroma does not extend to the hind portion of these sacs, for this locality serves as a sort of uterus, and is provided, while internal incubation is going on, with an albuminous secretion.

The various modifications of the generative organs in these fishes are a testis or ovary, without an excretory canal, or with a simple duct; a partial oviduct united to the ureter, but not continuous with the ovary; or a testis and ovary having a complex duct distinct from the ureter. In short, the products of the reproductive organs may be set free in the peritoneal cavity, becoming discharged externally by the abdominal pore or pores; or the products may be taken up by the open mouths of the fallopian tubes, or proper ducts may conduct them to their outlet. The claspers, as seen in the male sharks, rays, and their allies, are really intromittent organs. In the pipe-fishes other accessory organs exist, as the sub-caudal skinny pouch in the males of some forms, or the sub-abdominal pouch in the male horse fishes.

Among bony fishes breeding occurs in one of the following plans; (1) the eggs are hatched within the female organs, as seen in the viviparous blenny; or (2) as in the majority of these fishes, having been extruded as hard roe, they are subsequently fertilised by the milt of the male, which comes into contact with them when in the water.

There is much which still remains to be ascertained respecting the breeding of fishes in the sea. Some forms, as the herring, deposit eggs which sink to the bottom, and attach themselves to contiguous substances. Others, like the mackerel, pilchard, and cod, float; or others, like some of the flat fishes, have their specific gravity so nearly similar to that of the sea, that it requires the agitation of the waves to prevent them from subsiding. Most of the sea forms which are of commercial importance migrate at breeding time towards localities most suitable for the reception of their eggs, generally seeking banks, or being found nearer in shore, or in shallower waters, than those they generally inhabit; while in the gar-fish (*Belone*) and its allies filaments pass from all sides of the eggs, and thus attach them to any passing or stationary object.

But there are other marine forms termed anadromous, which leave the ocean, migrating into rivers, up which they ascend, often for long distances, and where they deposit their eggs, as the shad, salmon, or lampreys. Although the freshwater forms are not included in this Paper, I may remark that there are certain families of them in the tropics in which they are strictly monogamous, building nests, as a rule, for the reception of their eggs, and guarding their young until able to shift for themselves.

Our sticklebacks, both marine and fresh-water, construct nests for the reception of their eggs, the fifteen-spined one usually selecting a sheltered spot which pure sea-water reaches. Here it collects some of the softer kinds of green or red seaweed, which it joins with coralline tufts and threads, forming a pear-shaped structure, about as stout as a man's fist. Some tropical siluroids which do not form nests have a peculiar mode of protecting their eggs, the male carrying them about in his mouth.

Considering how the eggs of fish are deposited in the sea, it does not seem wonderful should many escape fecundation, and this would be probably still more common in such as are deposited in rivers. It is well known that eggs are a tempting bait for this class of animals, while they likewise are generally partial to fry, even of their own kind. In fact, we perceive some forms, as the sticklebacks, in which the male will guard the nest and protect the eggs and young, but after they attain to certain size, should they not depart and shift for themselves, the probabilities are that they will be devoured by their progenitors. Next we have forms, such as the salmons, that make a red or nest in the gravel at the bottom of a river, and subsequently care no more for the results, consuming either the eggs or fry should they come in their way. Lastly, we have forms which deposit their eggs in large numbers, as the herring, and then appear to take no further account of them.

The time of year at which spawning is effected varies in accordance with the locality and family of the fish. This, again, appears to be further susceptible of modifications, in accordance with the temperature of the water and many other local causes, while there are some fishes which breed once a year, and others are supposed to do so oftener. There does not appear a month in the year that the herring is not breeding off some portion of the British coasts.

The effect of spawning may render a fish, in an economic point of view, almost valueless, being positively unwholesome, while in other forms it does not cause its suitableness as food to be altered, and this is mostly in such species as deposit the least number of eggs.

The following figures give the number of eggs which have been observed in certain of our marine commercial fishes:—Cod, from 3,000,000 to at least 7,500,000; mackerel (at 1 lb.), 86,120; at 18 oz., 546,681; herring (at 8 oz.), 19,840; at 5 oz., 36,960; turbot (128 oz.), 385,200; brill (64 oz.), 239,775; flounder (24 oz.), 1,357,400; sole (14 oz.), 100,362; 16 oz., 134,466.

Respecting hybridism among marine fishes, it has not been so much observed as in fresh-water forms. A hybrid between a brill and a turbot is not very rare, but what becomes of these hybrids, as to the continuation of their kind, absolutely nothing is known.

The eggs of fishes kept in an aquarium appear to give [illegible] young, and those more sickly, than when taken from such as are kept in more natural conditions. Some breeding fish, as the conger, seem to be unable to extrude their eggs when in an aquarium, and, so far as I have observed, die in the vain attempt to discharge them, possibly owing to want of some particular form of pressure which they obtain when in a wild state. That pressure may be necessary, I would advert to M. Carbonnier's observations how the male of the curiously grotesque telescope-fish, a variety of the gold carp, acts as accoucheur. Three males pursued one female, which was heavy with spawn, and rolled her like a ball upon the ground for the distance of several mètres, and continued this process, without rest and relaxation, for two days, until the exhausted female, who had been unable to recover her equilibrium for a moment, had at last evacuated all her ova.

Respecting the artificial propagation of the eggs of marine fishes, except in America, but little has been attempted. It was found that a certain amount of motion was necessary in order to cause the eggs of the shad to develop, so a box was invented, having a wire gauze bottom, in which they were placed. These boxes were secured at an angle to floats, so that a current passing through kept the eggs in constant motion. The success was found to be great. Since then the hatching of cod and other marine fish eggs has been extensively carried out.

There are certain conditions of the water more or less suitable for the residence of fish, and among these temperature plays an important part, more especially in the sea, where it everywhere determines the distribution of animal life. It may act directly upon the fish through the water, or else upon the food upon which it subsists. It may delay or accelerate breeding, or even injure the eggs, if deposited, and thus affect the next year's supply. Irrespective of the *horizontal* circulation in the ocean, due to the action of winds and storms, there is likewise a *vertical* one, due to the polar cold. Chiefly from the Antarctic area there is an *underflow* of polar water, which passes towards the equatorial zone; while a complimentary *overflow* proceeds from the equator towards the pole.

Fish will recover, after having been apparently frozen, as observed by Sir J. Franklin in his 'Voyage to the Polar Seas,' when they appeared to be a solid mass of ice, and lived after having been thawed. The same phenomenon has been repeatedly observed in this country during the winter; but M. Pouchet has demonstrated that no animal really frozen is susceptible of revivication, as freezing disorganizes the blood. Animals may be surrounded by ice without being frozen, unless the temperature is very low.

Fish can exist below the ice for lengthened periods, and Arctic travellers have remarked that if a hole is broken they congregate to that place; but this may be due to an increased amount of light, not for the purpose of breathing, although when they thus congregate at one spot they would probably foul the water.

In an experiment made by M. Faure, he did not find that fish in an aquarium took the slightest notice of the electric light. It is well known that salmon and other fish in fresh water are attracted by a light. The effects, however, of electrical disturbance in the atmosphere are frequently perceived among the finny tribes, but more commonly in fresh than in salt water.

During the last few centuries, and the first decade of present, the theory was almost universally held that sea fishes, as the mackerel and herring, had their home in the colder north, from whence, at certain seasons, they migrated southwards in specified lines. Of late years it has been generally held that, instead of their making these long annual migrations, they merely pass from the shallower into the deeper waters, from whence they return as spring sets in, and impelled either in their search for food, or else seeking for a favourable locality in which to continue their species. It is often evident that temperature exercises a considerable influence on these migrations, while local circumstances may occasion certain forms to intermit visiting coasts which they have been accustomed to yearly resort to. This is more especially seen in the herrings and flat fishes, and, as a consequence, in those predaceous forms which prey upon them. Various conjectures have been hazarded as reasons for fishes forsaking certain localities, as the firing of guns in a sea-battle, burning of kelp on sea-shores, the regular running of steamboats which were not previously in existence, fouling of the water from various causes, and other reasons which will be shortly alluded to further on.

It is well known that strictly fresh-water fish, as carp, cannot, as a rule, live in sea-water; thus in Norfolk it has been observed that if the salt water pass up the rivers, the first fish that suffer are the pike, bream, and roach. Perch, however, will bear a strong admixture of salt, while eels seem to resist its influence altogether.

Marine fishes have been known to either become temporary or permanent residents of fresh waters. This has been sometimes due to their having ascended rivers or entered bays, when, with an ebbing tide, they were unable to return. In the Baltic, at its northern portion, certain marine fishes are found, where the water is scarcely saline, whereas they are absent from southern portions of that sea, where their presence would be naturally expected, had they obtained entrance from the German Ocean. The existence of these fishes, in a comparatively leaner and smaller condition in the Baltic than is perceived in their Arctic relatives, renders it in the highest degree probable that they are a remnant from the fauna of the Glacial Ocean. During the later portion of the glacial period most of Finland and the middle of Sweden were submerged, the Baltic, which was a gulf of the Glacial Ocean, being closed to the south. As the Scandinavian continent became elevated, the Baltic became cut off by land from the Arctic, whereas it has obtained an opening into the German Ocean, leaving it containing representatives of its former glacial fauna, but not the products of immigration through the Sound. In 1825 Mr. Meynell, of Yarm, in Yorkshire, recorded how he had succeeded in retaining smelts or sparling in a fresh-water pond which did not communicate with the sea, and how they not only bred, but throve there for successive seasons. Mr. Arnold, of Guernsey, in 1831, observed upon some experiments which he had personally undertaken in a three-acre lake, having a muddy, gravelly, or rocky bottom, and was principally filled with fresh water. Here for nine months in the year, cattle came to drink, but in summer the water was too salt, due to a supply from the sea being received through a tunnel. Bass, grey mullet, turbot, brill, plaice, soles, and smelt were introduced and throve, while the mullet, it was remarked, bred as freely as if they resided in the sea. After having been naturalised in this lake, the fish were transferred to ponds of spring water, where they not only lived, but did well.

Salt-water piscinæ have likewise been occasionally tried with success along our coasts. In Kenmare Bay, Mr. , in an inlet guarded by reefs of rocks in Sneem

Harbour, had a strong barrier of stones placed across the entrance, but through which every tide flowed and ebbed, leaving a sufficiency of water inside. Here mullet, whiting, bream, soles, and plaice, succeeded best; haddock also did well, but gurnards became pale in colour. Whiting were so tame as to feed out of the hand, and all assembled at the feeding time when the tray appeared.

Fish likewise occasionally seek refuge in other animals either temporarily or permanently. Mr. Peach at Peterhead observed some very small fishes playing around a medusa when an enemy came near. At once they rushed beneath the umbrella of one of these Cyaneæ and amongst its tentacles, and there remained in shelter until the danger had passed. Mr. Hardy mentions seeing a boatman cut a medusa across with a knife, when a number of small fish about two inches long were liberated.

Dr. Andrews observed upon the Holothuria, or trepang of the seas of China, that fish live inside it; in fact, that he witnessed instances of living fish entering the trepang. The same phenomenon has been observed by Professor Emery at Naples, where a *Fierasfer* chose for its abode the inside of a Holothuria, invariably entering tail foremost. It evidently obtains a subsistence here.

Then we occasionally find in our sea examples of the sucking-fish (*Echeneis*), which attaches itself to sharks or other large animals, in order to profit by the greater powers of locomotion possessed by their host. However, they draw no sustenance, but merely partake of such food as comes within their reach. These fish may be either free or attached to their host, and are termed *commensals*.

The importance of our sea fisheries may probably be ranked in point of value in the following order:—1. Cod fisheries, including cod, haddock, whiting, ling, coal-fish, and their allies; 2. Herring, which would include the herring, pilchard, anchovy, and shad, the first of these fisheries being the most valuable along the coast of Scotland; 3. Flat fishes, as turbot, brill, halibut, flounder, sole, plaice, &c.; 4. Mackerel; 5. Rays and skates; 6. Gurnards, sea breams, dories, &c.

These fisheries not only afford food to a great extent for the ever-increasing people of these islands, but employment for the fishermen, and likewise to a large number of individuals on shore engaged in the various trades with which fisheries are intimately bound up. Uninfluenced by droughts, they would, if economically worked, be capable of affording an almost inexhaustible harvest of food, and it is remarkable in what different lights fishing has been viewed in different times.

It is not my purpose to enter upon the laws which were in existence up to within the last fifteen years, when all were abolished. Our fish salesmen and our fishermen assert that some of our sea fish are visibly decreasing, for although the gross weight of fish brought to our larger markets is increasing, such is due both to inferior forms being withdrawn from the local fish markets, and larger boats, more men and nets, aided by steam power, being employed in order to supply the markets; irrespective of which the fisheries are gradually receding from our coasts, while the general size of the captured trawl and line fish is visibly diminishing, and the price augmenting.

Were a weekly return published of the various sorts of fish, their weight and their cost, the public would soon be in a position to judge for themselves whether the augmented price of fish is due to a combination of fish salesmen as some suppose, or rather to increased cost in capturing the ny tribes and conveying them to market.

In America the artificial propagation of sea fish is carried on in order to keep the stock in the ocean sufficient for the requirements of the people. Here everything is allowed to drift as it can, the size of the mesh of the nets is decreasing, and young fish as well as others, useless as food, are being captured for bait, while, as I shall subsequently show, our flat fishes are rapidly diminishing, enormous numbers of the fry being destroyed. The question must be some day considered whether a close time for sea fishes will not have to be instituted. By this I do not mean a general close season, extending to all fishes, but a prohibition against trawling within three miles of the shore during such times as the young of the more valuable fishes are about. The nurseries of the flat fishes, one would suppose, ought certainly to be protected during certain seasons. Also the possession of some species below a certain size ought to be prohibited. No regulations affecting fisheries upwards of three miles from the shore could be carried out unless under the sanction of an international agreement.

Before passing on from this subject, it will be as well to point out why it is that proposals for regulating fisheries may hardly be expected from fishermen. We may be considered to have two classes, of fisheries, one such as lobsters and crabs, where a supply from foreign ports keeps down the price, and, therefore, the fisherman finds it necessary to have a fair stock in order that he may be able to send his captures to market at the restricted price.* The second, and by far the largest class, consists of fresh fish, which cannot be supplied from abroad. Here the price in the market will depend on the amount received; if large, it is low; if small, it rises; consequently the loser is the purchaser, not the fisherman or salesman. Should, however, an increased quantity be desirable, and which is not obtainable from the better kinds, quantity is made up by hake, rays, skates, and other forms, which formerly were mostly consumed at the localities where they were captured, by the lower classes.

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* In February, 1880, a prohibition was issued that no berried lobsters, crabs under 4½ inches across the shell, and no soft crabs were to be taken for three years along certain portions of the Norfolk coast; while a close time was to exist from June 25th to July 25th inclusive. This regulation was issued at the request of the fishermen; for since about 1870 crabs and lobsters had been captured, irrespective of their

The various methods in use by the fishermen in order to obtain our most important commercial sea fisheries, may be divided into (1) net and (2) line fishing. The main forms of net-fishing are the drift-net, the seine-net, the bag-net, the kettle-net or weir, the trammel or set- net, the beam trawl, and the stow-net. Each of these will require a short and general description.

The drift-net is mainly employed for the capture of gregarious fishes, or such as swim in shoals, as the mackerel, herring, pilchard, and in some localities sprats, and is serviceable for securing such when residing some distance from land, and over deep water where they occasionally come to the surface. It may be likened to a wall of net,

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size and condition, until the fishery had become almost ruined. The captures during the years from 1879 to 1882 were as follows :—

In 1879 there were sent to the rail 668 pads.
" 1880 " " " 656 "
" 1881 " " " 2066 "
" 1882 " " " 3463 "

It is now petitioned that these restrictive measures be continued. The figures speak for themselves, both as demonstrating the effects of unrestricted license in fishing as well as the results of wholesome restrictions.

suspended by floats, so that its upper edge can be kept at or a little below the surface, and allowed to drift with the tide in any direction, and over any depth of water. It hangs down like a barrier directly in the course a shoal of fish is pursuing. The size of the mesh is in accordance with that of the species of fish it is desired to capture, being sufficiently large to permit it to push its head through but not its body, and it thus becomes meshed behind the gill-covers, which it opens to breathe. The drift-net is, as a rule, shot or payed out at night, and is generally more successful in dark weather, although it has frequently been observed that a rise of the moon, the time just following sunset, or at the commencement of dawn, are the periods when shoals are frequently observed to be on the move and strike the net. These nets are manufactured of cotton or hemp (twine), the former generally being preferred, as it is the most giving material and finest texture, consequently less likely to scare the fish. Twine-nets are stiffer, heavier, and occupy more space, but last the longer.

These nets are worked on a single line many hundred yards in length, those for mackerel even up to two and a half miles, and when thus employed are termed a fleet, drift or train of nets. The upper edge of the net is termed the "back," the ends the "heads," and the lower edge the "foot" or "sole." A rope runs along the back and heads, but generally not along the foot, as it is then less likely to be entangled in anything at the bottom. The net is set slack on the back rope in order to allow of a little play or giving when struck by the fish. Short lines are fastened every few inches, by which the back of the net is connected to a double rope, on which the corks or floats are placed for the purpose of keeping this edge or back of the net uppermost. From this again are ropes fastened to kegs or buoys which support it at any desired depth, or the cork line may have sufficient floats on it to keep the upper edge of the net at the surface of the water. The fleet of nets is connected to the fishing vessel by a warp of strong rope, to which each piece of net composing the fleet is fastened, and thus by seizings of sufficient length to allow the warp to sink nearly, if not quite, as low as the foot of the net. The warp not only assists when hauling in the net by lessening the strain, but should any accident have occurred it often serves to secure the various pieces of the net. The fishing boat to which the warp is attached has to maintain sufficient strain on the nets to keep them taut or extended, for which reason they are shot in the direction the wind is blowing. Every vessel while its fleet of drift-nets is in the sea ought by law to have two lights hoisted one above another at not less than three feet asunder.

The seine-nets employed in our fisheries are of three principal descriptions, the common or stop-seine, also termed a trawl in Scotland, the tuck-seine and the ground-seine. All are used for the purpose of encircling or surrounding fishes, and the middle or deepest portion is termed the bunt, and the lateral portion the sides or wings. Its upper edge or back is furnished with corks or floats, while its foot or lower edge is leaded. If worked entirely from boats it is shot in a complete circle; if from the shore in a semicircle. More than one net may be employed, as seen in the fishery for pilchards off St. Ives in Cornwall, when to the end of the large seine-net a smaller or stop-net may be attached. The boats commence shooting their nets from the point of junction, the larger seine being taken somewhat parallel to the shore, and the stop-net being carried towards the shore. The seine having been taken round the shoal, completes the circle by joining the stop-seine. By degrees the size of the circle is diminished by hauling in the stop-seine until the whole of the fish are enclosed solely in the large seine-net. This, with its contents, is hauled nearer the shore until it touches the ground, when it is moored in a suitable place, and the contained fish removed as may be desired by the fishermen.

The tuck-seine is a much shorter net, but very deep in the middle or bunt; this is shot inside the circle of the large seine which contains the fish, and as it is hauled in the foot of the bunt is raised so as to get the net underneath the fish and raise them to the surface. They are now removed by means of large baskets.

The ground- or foot-seine is a very widely employed form of net, and used for taking a variety of forms of fishes. The middle or bunt of the net usually has smaller meshes than the wings. A back and a foot rope are attached to a pole at either end, and to each pole is fixed the drag-rope for the purpose of hauling. One end of the drag-rope is left on shore, the net is then shot in a semicircle, and then returns to the beach with the other rope. Hauling is carried on from both ropes, and by degrees the parties approach, and meet before the bunt comes on shore, which is then drawn up with the enclosed fish.

The bag-net, also known as the kettle-net, is a species of fishing weir that is employed along the south coast from Folkestone to Beachy Head. By an arrangement of stakes, nets, and a pound, it turns the fish into a particular direction from whence there is no escape. It is constructed in two parts; the external or circular pound, which is not quite completed on the land side, from which it is distant from two hundred to six hundred yards, consists of stakes from ten to twelve feet high, enclosing as much as two hundred yards, and with the outer edge of the circle just below low-water mark at neap tides, the interstices between the stakes are filled in with old nets. A similar line of stakes and nets, from two hundred to six hundred yards in length, passes from inside the mouth or entrance of the pound in a direct line towards the shore. At high water the whole is covered by the sea, and any fish, as mackerel, passing along the shore, are stopped by the long barrier, following which they are diverted in their course into the pound. As the tide ebbs the fish are readily removed.

The trammel- or set-net, also termed tumbling-net in Cornwall, likewise includes such nets as are fixed or stationary when at work, and wherein fish are entangled in the meshes. There are two descriptions of these nets in use, which differ considerably one from the other. The simple set-net, employed in Ireland and many portions of the sea coast of the United Kingdom, is similar to a short drift-net, which is shot in the direction of the tide, and anchored and buoyed at each end at the desired spot, while a few corks are fixed along the back rope, and the foot rope is weighted. The mesh of the net is in accordance with the species of fish it is desirous of taking, while it is set very slack so as to enable the fish to be easily meshed. The proper trammel-net is composed of three distinct pieces or walls placed parallel one to the other, and fastened together along the back rope above, the foot rope below, and the head ropes at either end. The mesh in the two outer of these nets are large, and correspond in size and position, but the middle net has a much smaller mesh, and hangs very loosely. The whole of these three walls are now set or fixed by anchors in the direction of the tide, the back of the net having corks attached to it, and a buoy at each end, while the foot rope is weighted. A fish trying to push its way through this net carries a portion of the slack, small-meshed middle wall with it through the large mesh of the outer net or wall on the opposite side, and thus becomes trammelled.

The trawl, or beam-trawl, is that mode of fishing which is most important in supplying varied kinds of fish to our markets, and which, as at present carried on, is most injurious to our fisheries. The trawl fishermen, being permitted at all times and seasons to capture whatever they please, destroy and throw overboard large quantities of the young of some of the best of our sea fishes, and are occasioning a rapid diminution of our flat fishes. Some authors have pointed out that, as the eggs of the majority of marine fishes float,* they could not be deleteriously affected by trawling. But they overlook the fact that fishermen have two meanings for spawn, either the eggs of fish or the small fry, and it is these last that trawlers and shrimpers, and the numerous other forms of small meshed nets employed along the coast are accused of destroying in enormous numbers, a fact any unprejudiced person may readily satisfy himself upon. It may be difficult to obtain impartial evidence from fishermen on this score, the drifters and line fishermen being so strongly at variance with the trawlers, by whom they consider they are deleteriously affected. This consideration ought to render it imperative that inspectors of sea fisheries should not only annually visit every large fishing station, but likewise observe the fisheries where they are being carried on. Unfortunately, owing to the report of the Royal Commissioners for Sea Fisheries (1865), wherein it was suggested that all regulations should be abolished, and every one permitted to fish in the sea in any manner he pleased, it has not been deemed necessary to have any inspector of sea fisheries. Any investigations are carried on by the inspectors of salmon fisheries, and it is nobody's business to watch the state of the sea fisheries, collect statistics respecting the fish trade, or ascertain the habits of the fishes.

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* Mr. Holdsworth observes that the eggs of the cod and haddock float, and continues, "if such be the case with these two species of the same genus, there is hardly room to doubt that the very closely allied species, such as the whiting, coalfish, pollack, hake and tush, have precisely the same habit of spawning at the surface." Although such guess-work may prove correct, I would point out, that proper investigations ought to be made, as the eggs of the herring sink, while those of the closely allied pilchard float. And some forms in which eggs float, as the *Belone*, or gar-fish, have tendrils given off from the ova which attach them to any contiguous object, whether such object floats or whether it sinks.

A trawl or beam-trawl is a net constructed for capturing such species of fish as are usually found at the bottom of the sea, and more or less conceal themselves in the mud within the limits of the littoral zone, and rarely as deep as fifty fathoms, such as flat fishes, rays, skates, as well as other forms, as haddock in the North Sea, which occasionally resort there. The trawl is a somewhat triangular bag-shaped net, the mouth of which is at its base, and is kept open by a beam of wood which is horizontally attached to its upper edge, this beam being supported at a short distance, about three feet, off the ground at each end of its outer extremity by an irregularly stirrup-shaped iron head, termed a trawl-head. Superiorly a socket in the trawl-head receives the end of the trawl-beam, while the lower edge of the trawl-head is flat, straight, and termed the "shoe," and this is on the ground while the trawl is working. The net when at work has been well likened to an old-fashioned bed watch-pocket laid on its face, when its upper portion would be its back, the front edge of which, being attached to the beam, is raised by means of the trawl-head about three feet off the ground. The lower edge of the bag forms a very deep curve, continuous from the foot or shoe of the trawl-head on one side to that of the other, and this is protected by a foot rope made of old but rather heavy material, but which is intended to give way if caught in any obstruction, but by its weight disturbs any fish, which, darting forward, are almost sure to become captured in the net. The various portions of the net have received distinctive names. The bag or bosom gradually decreases in width from a little distance beyond its base or mouth to about eight or ten feet before it reaches its hind end, this last portion, termed the cod, being of about the same diameter throughout, and which is secured at its outer end by a cord. As this portion of the net, which generally contains the captures, is subject to considerable friction, its under surface is protected by what are termed rubbing-pieces, consisting of pieces of leather or else portions of old netting. The body of the net as it commences to decrease in size is subdivided into three portions, the purse on either side, and the bosom in the middle. The purse, which has smaller meshes than the body of the net, is constructed by fastening together the upper and lower parts of the body of the trawl-net, from where it commences to taper to so far as the cod, and dividing it into three portions or breadths, which posteriorly become of nearly equal widths. Prior to where the tapering of the trawl commences, a flap or valve passes across to prevent any fish re-ascending and thus escaping. The strong trawl-warp is attached in front to the vessel, and posteriorly to the bridle or span-ropes, one of which passes to the trawl-head on either side.

A trawler, in case of accidents, generally has two sets of gear on board, and although the net is said to last from two to four months, considerable repairs are needed, while the cod and under side have to be renewed two or three times. In such trawlers as continue out at sea for several days, ice is usually taken on board in order to preserve the captures. Trawling is more or less carried on throughout the year, but mostly during the winter months, as a sufficiency of wind is necessary. A tide of moderate strength is preferred. The net is towed in the direction of the tide, but a little faster. When shooting the net, the vessel must be moving through the water, and care be taken that in its descent the proper side is uppermost, while the trawling should be carried on where the surface of the ground is smooth. The gear is usually down a tide, or from five to six hours, owing to which and the pressure which bears upon the fish which are in its toils, very few of the smaller ones are alive when brought to the surface; or if they are, they are so injured that returning them to the sea is useless, unless as food for other fishes. Trawlers are likewise very destructive to the line fishermen, sweeping away their lines, also passing through the drift-net fishermen's fleets, while in shallow water they occasion considerable injury should they work over the beds of the shell fish. One can well understand the desire of the non-trawling fishermen, as expressed to Mr. Buckland, that they ought not to work nearer the shore than ten miles in the summer and fifteen in the winter.

The stow-net or bag-net is an enormous funnel-shaped net, as much as sixty yards in length, and having small meshes. Its mouth is square, while it gradually decreases in size as far as its end. It is used at the mouth of the Thames, also in the Solent and the Wash, for the purpose of catching sprats, while occasionally a shoal of young herrings enters its capacious maw. The vessel is anchored in a tideway, while from the same anchor four ropes pass, one to each corner of the mouth of the net. A wooden balk or beam is fixed across the upper edge of the mouth of the net, and another across its lower edge, while the bridles from the anchor are attached one to each end of these balks. Superiorly from the vessel two ropes pass down, one to each end of the upper balk, so that it may be raised from the vessel to the desired height, while the lower balk is weighted in order to cause it to sink, and thus keep the mouth open. This net is put overboard as the tide makes, and continues overboard in the tideway until nearly slack water. When it is desired to raise it, the mouth of the net is first closed by means of a chain, which passes from the centre of the lower balk through a ring in the centre of the upper balk, and is continued on to the vessel. These stow-nets are of various forms and patterns, while small ones are employed for the purpose of capturing whitebait.

Line fishing for taking commercial sea fish is divisible into two kinds, hand lining and long lining, the first being employed by an individual who holds the line in his hand, whereas the second is left in the sea a longer or shorter period before it is examined. I shall allude to these forms of fishing when remarking upon the cod-fish. Here I will only express my regret that the disastrous repeal of the fishery laws has led to partial ruin in many places, the total ruin in others, of our mussel beds, so much required as bait for fishing.*

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* Oysters being now almost exhausted, mussels are employed to take their place. The upholders of the repeal of the fishery laws must see how the destruction of the mussel beds is destroying the fishermen's bait, but they perversely reply, "Then use something else, as

It may not be amiss in this place to observe what great benefit would accrue to the fishermen who seek the mackerel, herring, or cod fishes, were a weekly notice circulated at our various fishery ports as to where shoals of fish are to be found; not only so, but the localities should be given by distances from known headlands and bearings by the compass. Thus in 1881, fishing-boats left the south-west coast for Ireland, anticipating falling in with the herrings, but on their arrival found the season to be an almost entire failure. They then migrated, and with success, to the north-east coast of England and Scotland.

The diseases, or causes of destruction, of sea fishes have not been much investigated, but it is reasonable to suppose that if impure and poisonous states of the water will prove injurious to fresh-water forms, it will prove no less injurious to marine species. Fish may forsake certain localities due to the presence of unwholesome substances. Thus at Mevagissey, in Cornwall, eels used to be frequently taken in the harbour, but now that the number of vessels there has augmented and trade increased — especially boat-building—a considerable quantity of tar is in the water, and they have not been observed for several years. If in any locality there is a steady decrease of certain tribes of fishes, while those which are being taken are deteriorating in size and condition, either the fishery is being over-worked, the water is less wholesome to the fish, or its food is absent. The polluted state of the waters at the mouths of most of our large rivers or many of our estuaries at once demonstrates the reason why they are forsaken by the finny tribes. It

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small or soft crabs, or young herrings." Pride appears to prevent them proposing to retrace their disastrous steps. When will they think more of the good of the fisheries and fishermen of which we much, but towards which we see so little attempted?

seems likewise very probable that the screws or paddles of steamers may prove destructive to a considerable amount of the eggs and fry of surface fishes. As to the predaceous fishes and other animals which are detrimental to fisheries, they will be alluded to when describing the different species.

Fish are likewise much affected by parasites; some of these are external and attack the surface, as fish lice; they can move from place to place and select some suitable spot where they fix themselves by means of their hooked and prehensile antennæ. Others are more sedentary, frequently having their heads deeply buried in the body or tissues of its victim. Having no powers of locomotion, the whole of their external organs are often merely rudimentary. They are seen in the eyes, gills, roof of the mouth, nostrils, vent, skin, and on the fins. Some forms, again, are internal and attack any of the internal organs of the host which they afflict with their presence.

Fish may be employed as food either fresh or cured; while the latter embraces such as are dried either in part or wholly, or pounded, and then dried in the sun, shade, or by artificial means; or smoked partially or wholly, salting or drying being used or abstained from; or salted either dry or in pickle in various ways, while sugar may be employed in the place of salt; or preserved by the exclusion of air or with the assistance of acids; or by keeping the fish by means of natural or artificial cold at a temperature below that at which fermentation or decay sets in.

The geographical distribution of our fishes has been more or less examined by various naturalists whose views have not invariably been in accord one with another. Certain terms have been instituted partly to convey to the worker an insight into the habits and distribution of this class of animals. Fresh-water forms have been divided into the river or *fluviatile*, and the lake or *lacustrine* classes. *Catadromous* has been proposed for such species as eels, which appear to pass a large portion of their lives in fresh waters, but descend to the sea or littoral zone for the purpose of breeding. Sea fishes have been subdivided into the *pelagic*, or strictly marine forms; the *littoral*, or coast species, and the *anadromous*, which leave the sea for rivers, up which they ascend in order to deposit their eggs in fresh waters, where the young of some, as the salmon, are reared; but not so of others, as the shad.

Pelagic fish, or the strictly marine forms, may be classed as those which are commonly found at the *surface*; mid-water or *median*; and such as reside in the depths of the ocean, or the *abyssal*. The littoral zone is that portion of the sea which extends from the shore to about 100 or 150 fathoms, a depth at which the direct rays of the sun are limited—a region of light. Through this space almost any of the littoral forms of fish may wander, and into this zone pelagic forms may range in order to prey upon their neighbours, deposit their ova, or having been driven in due to sickness. In the littoral zone there are constant migrations, and fishes from deeper localities press in after their prey. Professor Agassiz considers, and with considerable grounds, that a *continental* zone may be traced in the ocean, extending from the littoral belt to 450 or 500 fathoms, which in some localities is represented by a deep slope and where the diminution of temperature is very rapid. The abyssal, which I here consider commences at about 100 to 150 fathoms (thus excluding the continental zone), extends from the littoral zone to the sea bottom to the greatest depths. Here the temperature is low, darkness more or less com- the forms of animal life appear to have remained undisturbed, geologically considered, for a long period. Almost everywhere at 500 fathoms, everywhere at 1000 fathoms, there is almost an entire absence of currents in the water; any movement must be of a molecular nature only, excessively slow and quite imperceptible to animals; while the conditions of life, at least from 500 fathoms downwards, do not show any zones of distribution in its fauna. Deep sea, or abyssal forms as already remarked, have large eyes, or may be entirely blind.

Irrespective of the fish which more or less continue in our seas throughout the year, wanderers or occasional visitors are likewise captured; some of these are cosmopolitan in their habits, others are residents in the colder north, from whence they may have wandered at first perhaps in the under-flow from the Arctic Ocean; or we may have species along our south or east coast mostly during the summer months from the Mediterranean, or ascending along our western shores with the Gulf Stream from the more sunny south. The distribution of the various genera and species will be detailed further on.

BRITISH FISHES.

SUB-CLASS I.—BONY FISHES OR TELEOSTEI.

ORDER I.—SPINY-RAYED FISHES OR ACANTHOPTERYGII.

FAMILY I.—PERCHES (*Percidæ*).

GENUS I.—Sea Perches (*Labrax*, Cuvier).

Geographical distribution.—This marine, and in some localities river, form of perch extends from the Arctic regions in Europe to the Mediterranean and Egypt; also along the coasts of North America; while one species has been taken at the Celebes.

1. The Bass (*Labrax lupus*).

Names.—This was the "sea wolf" of the Greeks, the "wolf" of the Romans. *Sea dace*, Kent. *White Salmon. King of the Mullets. Gapemouth* in Scotland.

B. vii., D. 8–9 | $\frac{1}{12-13}$, V. $\frac{1}{5}$, A. $\frac{3}{10-12}$, L.l. 72, L. tr. $\frac{14}{18}$, Cæc. pyl. v., Vertebræ, $\frac{11}{13}$.

Length of head, 3¾ to 4; height of body, 4¼ to 4⅓ in the total length. *Eye.*—Diameter 4¼ to 5 (or even proportionately larger in small examples) in the length of the head, 1¼ to 1½ diameters from the end of the snout, and 1¼ apart. Hind edge of the preopercle strongly toothed, with three strong ones forwardly-directed along its lower limb. Jaws of the same length in front: the maxilla reaches to below the middle or first third of the eye. *Teeth.*—Villiform in the jaws: in a crescentic spot on the vomer, in a band on the palatines; also on the base of the tongue. *Fins.*—Third anal spine slightly longer than the second, caudal forked. *Colours.*—Grey along the back, becoming lighter on the sides and beneath. A darkish blotch on the upper two-thirds of the gill-covers. Back, tail, and anal fins externally stained with grey; ventral and breast fin yellowish-white. *Habits.*—A strong, active fish, generally living in shoals, and, though a marine form, ascending rivers above tidal influence. It mostly arrives from the deep sea about May, returning there in October or November, while large ones are not generally seen throughout the winter months. It consumes almost every form of animal substance, preferring such when living, preying principally upon small fishes and crustacea, and has likewise been recorded as consuming sea-weeds. Partial to sea lice, *Onisci*, it has been observed, in order to obtain them, to venture among rocks during tempests, when its prey becomes washed out of its abode; and it is during such stormy weather that it hunts along the shore, even in shallow water, although at other times it selects its station under some sheltering rock, from which it darts out on passing prey. It is very fond of young sprats and herrings, while it prefers the vicinity of wooden piers to those constructed of stone, evidently owing to the greater abundance of food at the former to what obtains in the latter locality. The fry of sand-launces, *Ammodytes*, father-lashers, *Cottus bubalis*, young whiting, and mullet have been found in their stomachs.

They have been kept with success in fresh-water vivaria by Mr. Arnold in Guernsey, Mr. McAllum in a lake near Plymouth, and by other persons elsewhere. Dr. McCulloch asserted that their flavour was much improved by the change from salt to fresh water.

Means of capture.—Beam-trawl, small seine-nets, also by deep sea lines and hand lining. In Cornwall the fishermen state that they are unable to take them in seine-nets unless such can be dragged on to a sandy beach, for otherwise, so soon as the foot-rope is raised, so surely do they swim away below it. They have even been credited with forming a depression in the sand by means of their tails, and here they are said to ensconce themselves while the net passes over them. Anglers use a long and strong rod, with suitable lines, and try their luck from pier-heads or projecting rocks, or else from a boat, which is slowly and quietly propelled along. The flood tide is usually more likely to prove successful than the ebb, while the water should not be too clear. This fish takes a bait very freely at times; occasionally nothing will tempt it; while, if hooked, it shows great ingenuity in escaping, often succeeding in severing the line. For baits the lug-worm, trolling with a live sand-eel, or an artificial indiarubber bait, are found very killing; also a soft crab, slice from a mackerel's tail, or slip of a cuttle-fish.

Breeding.—During the autumn months, near the mouths of large rivers, or along sandy beaches.

As food.—Its flesh is considered excellent if eaten on the same day that the fish is captured, but it rapidly deteriorates, and then possesses a strong and oily taste.

Habitat.—It is most common in Britain during the summer months, and more especially along the south coast, decreasing in numbers towards the north, but is present off the Isle of Man. In Scotland it is rare to the north of the Firth of Forth, and has not been recorded from the Orkneys and Shetland Isles. In Ireland it is known, but not abundant, along the south coast, but decreases towards the north.

Yarrell records one of 28 lb. weight; Buckland one of 22 lb., from Herne Bay; and Pennant one of 15 lb.

FAMILY II.—RED MULLETS (*Mullidæ*).

Geographical distribution.—From Scandinavia through the seas of temperate Europe, as far south in the Atlantic as Madeira and the Canary Isles; also found in the Mediterranean, Adriatic, and Black Seas.

This fish was termed *Triglé* by the ancient Greeks under the supposition of its breeding three times every year, or else, according to Athenæus, that it only bred three times throughout its entire existence, due to its internal organs becoming destroyed by parasitic worms. The Romans are said to have changed its name to *Mullus*, it has been conjectured owing to its colour, which resembled that of sandals worn by the Alban kings, and subsequently by the Roman Consuls, and which were afterwards adopted by their Emperors under the designation of *Mulleus.*

Mullets in the time of the Cæsars seem almost to have divided with them the allegiance of the Roman people, all of whom were desirous that it should adorn their tables and give éclat to their entertainments, perhaps because this fish realised high prices in Rome, where the purchaser who paid the most extortionate sum obtained notoriety. As much as £240 was realised for a red mullet of unusual size procured upon the day of a grand feast. But as time went on the abnormal value decreased, until in the fourth century we are told by Macrobius that it was not excessive. When, however, this fish was at the summit of its glory, Rome was no longer able to supply sufficient, consequently it was imported from Corsica, Sicily, and elsewhere. Salt-water vivaria were constructed at an enormous expense, but Columnella observed that hardly one red mullet out of a thousand survived its transfer to such localities, which he ascribed to their nobility spurning confinement. Seneca tells us that at their feasts those were most valued which expired in the presence of the guests. Introduced in glass globes, the red mullet was drowned in piquant sauces, or slowly boiled on the banqueting table before the company, who were thus enabled to view the varied and beautiful changing hues of the dying fish.

1. Red Mullet, or Surmullet (*Mullus barbatus* and *M. surmuletus*).

Names.—Known as the *red mullet, surmullet, plain red mullet, striped red mullet.*

B. iv., D. 7–8 | $\frac{1}{8}$, V. $\frac{1}{5}$, A. $\frac{2}{6}$, L. l. 38–40, L. tr. $\frac{2\frac{1}{2}-3\frac{1}{2}}{6-7}$, Cæc. pyl. 18–22, Vert. $\frac{10}{14}$.

Length of head 4 to $4\frac{1}{2}$, height of body $3\frac{3}{4}$ to $4\frac{1}{2}$ in the total length. *Eye.*—High up, 1½ to 2 diameters from the end of the snout; 1½ diameters in the postorbital portion of the head, and 1 to 1⅓ diameters apart. Profile of forehead more or less steep, in some examples descending almost vertically. Preorbital much higher than broad, sometimes nearly twice as much. The posterior extremity of the maxilla reaches to beneath the anterior edge of the eye. *Barbels.*—Reach to below the hind margin of the preopercle. *Teeth.*—In two rows of obtuse ones in the lower jaw, but none in the upper; rounded ones on the vomer and palatine bones. *Fins.*—Spines of the first dorsal having weak extremities, the second to the fourth about the same height, and equal to two-thirds of the length of the head; subsequently they decrease in length. Second anal spine much longer than the first. *Scales.*—The majority of examples have 2½ rows between the lateral-line and the back, but some have 3½. *Colours.*—Vary considerably: in the red mullet, *Mullus barbatus,* the colours being plain red; but in the surmullet, *M. surmuletus*, there are longitudinal stripes along the body, which may be concealed, while the rich satin-red colour becomes vivid after the removal of the scales. Professor Steindachner examined no less than seventy-five examples, and found so many variations in the form of the profiles of their snouts, that he came to the conclusion that they were both merely varieties of one species. Whether two species exist or not, it is very evident that all the British examples are within the limits of variation in one species.

Habits.—In normal seasons these fish are found along the southern coast, in Cornwall at about twenty miles out to sea in March, and from nine to ten in May, when they come in with the mackerel, but are said to be of a roving disposition. They are evidently off our coast all the year round, being taken during the winter in the English Channel; and in one winter a Plymouth trawler took so many that they realised £20. Opinions vary as to the food they eat. The ancients considered them very foul feeders, even supposing that they devoured corpses. They live on small crustacea and molluscs, and in an aquarium appear partial to pieces of mussel. It is interesting to observe how they employ their barbels as feelers along the bottom while in search of food.

Means of capture.—Ground-seines, trammels, beam-trawls, and mullet-nets. It has been remarked at Penzance that on their first appearance they are mostly taken in beam-trawls; at the succeeding spring-tides they augment in numbers, and are captured in ground-seines, sometimes as many as 50 or 60 in a night. The reason they are occasionally taken in drift-nets has been assumed to be that, when changing their locality, they swim near the surface, even should the water be very deep. Occasionally they take a bait. On being captured, or as soon as landed, if intended for the London market, the scales are generally stripped off by the thumb-nail, which occasions a contraction of the pigment cells, for were this not done, the brilliant red colour observed in those exposed for sale at fishmongers' would be less apparent, and the fish of diminished value for the table. Irrespective of this, were the scales not removed, and the fish to dry while in transit to the market, they (the scales) would become very adherent, and it would be difficult to remove them without tearing the skin. In some localities, as Penzance, were the scales removed the fish would be unsaleable. Those taken in a trammel are of more value than such as are captured with the beam-trawl, because, being less bruised, they keep longer.

Breeding.—From July until September, during which period they become very fat.

As food.—This fish is held in great esteem, the finest examples coming from the English Channel. Its flesh is of good flavour—white, firm, flaky, destitute of any superabundance of fat, and easy of digestion. Its liver is deemed its most savoury morsel, to which its head was in olden times ranked next in delicacy.

Habitat.—Most numerous along the south and west coasts, rapidly decreasing in numbers towards the north; still in some seasons it is abundant off Norfolk, and during one week in May, 1831, 10,000 were sent to London. It has been taken in the Isle of Man. It has been recorded from the Moray Firth and east coast of Scotland as far as Berwickshire; also in Ireland, more especially along its south coast.

Its usual size runs up to 1 lb. to 2 lb., and about 14 inches in length, but it has been taken at Penzance up to 16¾ inches long, and 2 lb. 6½ oz. weight. Yarrell records one of 3 lb. 6 oz. from Weymouth.

FAMILY III.—SEA-BREAMS (*Sparidæ*).

Geographical distribution.—Seas of temperate and tropical regions; some forms enter fresh waters.

1. Old Wife (*Cantharus lineatus*).

Names.—*Black sea-bream.*

B. vi., D. $\frac{11}{12}$, V. $\frac{1}{5}$, A. $\frac{3}{10}$, L. l. 72, L. tr. $\frac{9}{19}$, Cæc. pyl. 4, Vert. $\frac{10}{14}$.

Length of head 4¼ to 4½; height of body 2¼ to 3 in the total length. *Eye.*—3 to 3¼ diameters in the length of the head, ¾ to 1 diameter from the end of the snout, and 1 apart. The maxilla reaches to beneath the front edge of the eye. Posterior edge of preopercle finely roughened. *Teeth.*—Cardiform in both jaws, with the outer row somewhat the largest, and slightly compressed; none on the vomer, palatines, or tongues. *Fins.*—Dorsal spines of moderate strength, increasing in length to the fourth or fifth. Anal spines shorter than the rays. *Air-bladder.*—Ending posteriorly in two horns, which are separated one from the other by the interhæmal spines. *Colours.*—Gray, glossed with gold, becoming lighter on the sides and beneath; cheeks and forehead glossed with purple. Below the lateral line are three or four parallel, or occasionally irregular, horizontal bands along the body, which have a golden tint. Dorsal, dark coloured; the other fins, with dark edges. The colours are subject to great variation.

Habits.—A gregarious fish, which prefers rocky localities, feeding upon the finer kinds of seaweeds. It frequents bays and harbours, and is frequently taken by anglers fishing from the shore. It is more abundant about July and August, after which period it retires to deeper water. An example has been captured as late as Christmas after a cold season, and a second in February, having the roe well developed. In aquaria it is found to be fond of shrimps.

Means of capture.—Generally during summer and early autumn by angling, the baits being lobworms or bits of mussels; also by nets.

As food.—It is little esteemed, its flesh being soft; those taken late in the season are said to have the flesh pretty firm, should they be captured on the French side of the Channel.

Habitat.—Rare in Northern Europe, becoming more common along the west and south coast of England, and in the Atlantic, so far as Madeira and the Canary Isles. It abounds throughout the Mediterranean. It is rare in Ireland.

It has been taken up to 20 inches in length.

II.—SEA-BREAMS (Genus, *Pagellus*).

Geographical distribution.—From the seas of Scandinavia along the shores of Britain, to the Canaries and Cape of Good Hope; also throughout the Mediterranean and Black Sea.

These fishes are commonly known as "sea-breams." Off Cornwall they have been observed to come in shoals at night-time to feed upon the pilchards entangled in the fishermen's nets, and which they are accused of rapidly clearing: this appears to be more especially the case during moonlight nights, at other times they seem to be ground-feeders. In Cornwall when two-thirds grown they are known as *grobman*, if younger as *chads*.

1. Common Sea-bream (*Pagellus centrodontus*).

Names.—Sharp-toothed sea-bream; red gilt-head; chad along the south-west coast if young; *Boger*, Cornwall, if half-grown, and *grobman* if two-thirds. In Ireland as *murranroe* and *barwin* (co. of Antrim); *gunner* on the north-west coast; *carf, carp,* and *sea-bream* on the north-east, and *brazier* on the north.

B. vi., D. $\frac{12}{13}$, V. $\frac{1}{5}$, A. $\frac{3}{12}$, L. l. 75, L. tr. $\frac{7}{16}$, Cæc. pyl. 4, Vert. $\frac{10}{14}$.

Length of head, 3¾ to 4; height of body, 3¼ to 3½ in the total length. *Eye.*—3½ to 3⅓ diameters in the length of the head, 1 diameter from the end of the snout, and also apart. Preorbital widest anteriorly, its greatest depth being scarcely equal to half its length. The maxilla reaches to beneath the front edge or even first third of the eye. *Teeth.*—Three or four irregularly placed rows, with rounded crowns and of different sizes, are present laterally and posteriorly in either jaw; none on the vomer, palatine bones, or tongue. *Fins.*—Dorsal spines strong, the fourth and fifth the largest; rays shorter than the spines, the last two somewhat thickened, but not scaled nor adherent together. Pectoral as long as the head, third anal spine somewhat longer than the second. *Scales.*—Seven rows between the eye and the angle of the preopercle. *Colours.*—Scarlet tinged with orange, becoming lighter beneath. A large black spot on the shoulder, intersected by the lateral-line, but absent in the young.

Habits.—Appears to be very sensitive to cold, and in the winter retires to the deep sea, not re-appearing until the weather is warm. It frequents the vicinity of rocks and seaweeds, and sometimes congregates in enormous numbers, especially near the end of the summer, when schools of them have been mistaken for pilchards. Couch records how, on one occasion, 20,000, and on another 60,000, were taken at one time. Those of the same size appear to keep together. They feed upon small fish, crustacea, and seaweed. In 1874 a vessel laden with wheat was wrecked in Cornwall, and soon afterwards sea-breams were taken which were found to have been feeding upon the wheat; they were in good condition.

Means of capture.—Either by nets or using a bait as the lugworm, shell fish, herring fry, or a slice from a mackerel.

Breeding.—Towards the end of the year or in the winter months.

As food.—Not much esteemed, as they soon become stale and tainted, but large numbers are disposed of throughout the Midland counties. They salt badly. In

Ireland they are prized in some localities, as co. Down, but hardly esteemed in Belfast.

Habitat.—In Great Britain it ranges from one extremity to the other, abounding along the southern and western coast, but diminishing in numbers towards the north. It has, however, been taken in very large quantities in the Moray Firth, where it is known as the *siller-fish.* In Ireland it is common all round the coast. It is captured up to 5 lb. weight.

2. Spanish Bream (*Pagellus bogaraveo*).

B. vi., D. $\frac{12-13}{12-11}$, V. $\frac{1}{5}$, A. $\frac{3}{10-12}$, L. l. 71, L. tr. $\frac{7}{15}$, Cæc. pyl. 5, Vert. 22.

Length of head, 3⅔ to 4; height of body, 3⅓ to 3¼ in the total length. *Eye.*—Diameter 3 to 3¼ in the length of the head, ¾ of a diameter from the end of the snout, and about 1 diameter apart. Preorbital much narrowest posteriorly, its greatest height somewhat less than half its length. The maxilla extends to beneath the first fourth of the eye. *Teeth.*—Rather fine, the anterior ones in the outer row in the upper jaw rather larger than the others; posteriorly two or three rows of molars, having rounded crowns in the upper and two in the lower jaw. *Fins.*—Dorsal spines of moderate strength, the fifth the longest, pectoral reaches to opposite the first third of the anal fin. *Scales.*—Six or seven rows between the eye and the angle of the preopercle. *Colours.*—Pinkish or silvery, the pectoral fin having a dark base and a dark spot in the axilla. During life numerous small blue spots are seen on the body. Fins pinkish.

Habitat.—This is one of the best known forms along our southern coast, and is taken during the summer and autumn. It attains to scarcely more than two-thirds of the

f the common sea-bream.

3. Erythrinus Sea-bream (*Pagellus erythrinus*).

Names.—The snapper, Devonshire ; *King of the breams ; pandora.*

B. vi., D. $\frac{12}{10}$, V. $\frac{1}{5}$, A. $\frac{3}{8-9}$, L. l. 56–60, L. tr. $\frac{6-7}{16}$, Cæc. pyl. 4, Vert. $\frac{10}{14}$.

Length of head, $3\frac{3}{4}$ to 4 ; height of body, $3\frac{1}{4}$ to $3\frac{1}{2}$ in the total length. *Eye.*—Diameter $3\frac{2}{3}$ to $4\frac{1}{2}$ in the length of the head, from $1\frac{1}{2}$ to 2 diameters from the end of the snout, and the same distance apart. Preorbital high, its height equalling from $\frac{1}{2}$ to $\frac{2}{3}$ of its length. The maxilla reaches to nearly beneath the front edge of the eye. *Teeth.*—Anteriorly cardiform, with two rows of molars posteriorly in either jaw, occasionally three rows in the upper in large examples; none on the vomer, palatine bones, or tongue. *Fins.*—Dorsal spines of moderate strength, the third the longest; the last two rays not enlarged nor scaled. Pectoral as long as, or even longer, than the head. Second and third anal spines of about the same length and strength. *Scales.*—Six rows between the eye and the angle of the preopercle. *Colours.*—Of an orange scarlet, becoming lighter beneath; in some examples the body is silvery, only just tinged with red or rose colour. Fins coloured externally with orange. In some large ones there are often blue spots over the body, and which may even be seen in the "chads."

Habits.—It is a migratory species, not uncommon, but most usually found during the summer and autumn, retiring to deep water as the winter sets in. Its habits appear to be somewhat solitary, while it is generally taken at a depth of several fathoms.

Bait.—Mussels are mostly employed, but small fishes, crabs, and even vegetables, are consumed by it.

As food it is not much esteemed.

Habitat.—Common on the south and west coasts of England, but more rare towards the north and in Scotland. It has been taken on the south-west coast of Ireland.

There are also two other but rare British forms of sea-breams, but which cannot be deemed commercial as they are but seldom found in the fish markets. They are Owen's sea-bream, *Pagellus Owenii*, and another smaller form, *P. acarna*.

FAMILY IV.—BULL-HEADS (*Cottidæ*).

Geographical distribution.— Arctic regions of Europe, Asia, and America, also the North Atlantic Ocean of both hemispheres, descending into temperate zones. Found both in the fresh and salt water.

There are two marine species of *Cottus*, the *C. scorpius* and *C. bubalis*, both exceedingly useful as food for larger forms, but otherwise of no commercial importance.

The second genus of this family are the gurnards or *Triglas*. Their common English name is derived from an ancient British word signifying a firm or rugged structure, and as such considered applicable to their heads. Many species are able to produce sounds beneath the water, or on their being removed from their native element. From this has originated their Italian name *organo*, and their French designation *grondin*. The Romans termed them *lyres*, either due to the sounds they made, or because they bore a fanciful resemblance to the ancient "lyre."

Habits.—Gurnards are rather voracious, and mostly swim near the bottom of the sea, where they feed upon crustacea, small fishes, and other prey. The free filaments belong-[illegible] their breast-fins have a certain similarity to elongated fingers, and are employed as feelers, used as a means of aiding progression, or even for the purpose of drawing food towards the mouth. They live for some time after their removal from the sea, and on being touched erect their dorsal spines and at the same time emit sounds from which many local names have had their origin. They have also been reputed to emit light from their heads when springing out of the water, and which Lacépède likened to a shooting star; but it has been surmised that such may be due to their conveying after them certain invertebrate animals that have luminous properties.

Means of capture.—As gurnards generally swim near the bottom they are commonly taken by the beam-trawl or by hooks and lines; a silvery slip from a sand-launce, or young sprats or herrings, three or four being threaded on to each hook, forming an attractive bait. Long lines, with baited hooks, are used in some localities for gurnard fishing.

Breeding.—Sars has found their ova floating at sea, so it appears almost certain that they may be included among those forms which do not deposit it at the bottom.

As food they have always been held in fair estimation, but owing to the firmness of their flesh they are not so digestible as many other forms of fishes, which are as readily obtainable; while some species, due to their small size, are deemed unsuited for the table, and others are so inferior as to be considered worthless in certain districts. In some places the term "souced gurnard" is employed as a term of contempt, as when Shakespere, in King Henry IV., act 4, scene 2, makes Falstaff say, "If I be not ashamed of my soldiers I am a souced gurnet."

Geographical distribution.—Coasts of Europe, being very abundant in the Mediterranean. One form which extends across the North Atlantic is found on the western shores of North America. To the *south* this genus passes round the west coast of Africa and from the Atlantic to the Indian Ocean, but seems to be absent from the east coast of Africa, the shores of India, and contiguous islands.

1. Streaked Gurnard (*Trigla lineata*).

Names.—Lineated gurnard; French gurnard; rock gurnard; rabbit-fish.

B. vii. D. 9–11 | 16–17, V. $\frac{1}{5}$, A. 16, L. l. 66, Cæc. pyl. 10, Vert. $\frac{15}{20}$.

Length of head $4\frac{1}{2}$ to $4\frac{3}{4}$; height of body 5 to $5\frac{1}{2}$ in the total length. *Eye.*—High up, almost touching the dorsal profile, $1\frac{1}{2}$ to $1\frac{2}{3}$ diameters in the postorbital portion of the head, 2 diameters from the end of the snout, and $\frac{3}{4}$ to 1 diameter apart. Interorbital space deeply concave; profile of snout descends abruptly, is almost vertical in the adult. Two or three spines at the anterior-superior angle of the orbit. Bones of the head with stellated ridges. Angle of preopercle usually with blunt but sometimes with sharp projections: supra scapular roughened along its upper edge and terminating posteriorly in a sharp spine: scapular strongly ridged, likewise terminating in a strong spine. The maxilla does not reach to beneath the eye. *Teeth.*—Fine in the jaws, present or absent from the vomer: none on the palatines or tongue. *Fins.*—Second dorsal spine the longest, roughened anteriorly. Pectoral reaching to above the third to the seventh anal ray. *Lateral line.*—With about 66 denticulated and serrated spines, equal to half the number of the rows of scales above the lateral line: the keeled row along the bases of the dorsal fins well developed, and consisting of about 25 scales. Passing from the back down the sides are numerous raised lines or ridges which give the fish its characteristic appearance. *Air-bladder.*—Oval, rounded at either end. *Colours*—lake superiorly and on the sides, becoming white beneath. Narrow vertical red bands pass from the back down the sides. Dorsal and caudal fins reddish brown, edged externally with red and covered with numerous irregular spots and blotches. Pectoral of similar but darker colours, the spots almost forming transverse bands. Ventrals reddish-brown internally, having lighter red edges. Anal yellowish grey, with a pink outer edge.

Habits.—This fish usually keeps near the bottom, but is sometimes captured in nets which do not descend nearly so low, while it has been occasionally observed springing out of the water. It appears to restrict itself to certain localities, probably due to the food which may be present. One was obtained in a net which was floated over 30 fathoms of water. It eats crustacea and small fish, while pebbles and vegetable substances have been found in its stomach.

Means of capture.—Often taken in trammels set for surmullet or with the trawl, but rarely on baited lines. In an aquarium it feeds upon mussels and shrimps.

As food equal to the elleck, *Trigla pini.*

Habitat.—In Britain it is most numerous along the south coast; merely stragglers have been observed in Scotland. In Ireland it is not common.

2. Elleck or pine-leaved Gurnard (*Trigla cuculus*).

Names.—*Red* or *cuckoo-gurnard; soldier; pine-leaved gurnard.*

B. vii., D. 8–9 | 18, V. $\frac{1}{5}$, A. 16–17, L. l. 73–76, Cæc. pyl. viii., Vert. $\frac{15}{21-22}$.

Length of head 4 to 4½; height of body 6 in the total length. *Eye.*—1¼ diameters in the postorbital portion of the head, 1¼ diameters from the end of the snout, and ¼ diameter apart. Interorbital space concave. Profile from eye to snout descends abruptly. Two or three small spines at the anterior superior angle of the orbit. Bones of the head with stellated ridges. Opercle with a well-developed spine. Angle of preopercle armed with a spine. The maxilla reaches to beneath the front of the eye. *Teeth.*—Fine in the jaws and vomer, none on the palatines or tongue. *Fins.*—Second dorsal spine longest, being two-thirds that of the head. Pectoral reaching to above the third or fourth anal ray. *Scales.*—Those along the lateral-line unarmed, but forming lineated plates, very much deeper than wide, occasioning the lateral-line to appear as if crossed by about 72 vertical folds of skin. Ridge along the bases of the dorsal fins having about 27 spines. *Air-bladder.*—Anteriorly with two short and rounded prolongations. *Colours.* — Rosy, dashed with orange, which is most developed on the head, abdomen whitish. Pectoral fins yellowish, with irregular greenish bars.

Habits.—Keeps near the bottom in moderately deep water. Feeds on small fishes, molluscs, and crustacea.

Means of capture.—Largely captured by the beam-trawl, but also readily takes a bait.

Breeding.—Spring months up to about June.

As food.—Large quantities are consumed in England, but it is not held in so much estimation in Scotland.

Habitat.—From Northern Europe to the Mediterranean, also the American shores of the North Atlantic. It is common around the British coasts, especially on the south and west; it is also found, but not so abundantly, along the Scottish coasts. Common in Ireland, especially along the south and east coasts. It attains to at least 18 inches in length.

3. Tub-fish (*Trigla hirundo*).

Names.—Sapphirine gurnard; tub-fish or *tubbot; sea-crow; red tubs; smooth sides.*

B. vii., D. 9 | 16–17, V. $\frac{1}{5}$, A. 15–16, Cæc. pyl. x., Vert. $\frac{14-15}{19}$.

Length of head $3\frac{1}{2}$ to 4; height of body 6 to $6\frac{1}{2}$ in the total length. *Eye.*—$1\frac{1}{4}$ to $1\frac{1}{4}$ diameters in the postorbital portion of the head, 2 diameters from the end of the snout, and 1 apart. Interorbital space deeply concave. Profile of snout oblique. Angle of preopercle acute and with two sharp spines in the young. The maxilla scarcely reaches to beneath the front edge of the eye. *Teeth.*—Fine ones in the jaws and on the vomer, none on the palatines or tongue. *Fins.*—Second spine of first dorsal fin as long as the snout. Pectoral usually longer than the head and reaching to above the seventh anal ray. *Scales.*—Nearly 200 irregular rows descend to the lateral-line which is smooth. From 25 to 27 spinate plates along the bases of the dorsal fins. *Air-bladder.*—Large, trilobed, and anteriorly produced into two short horns. *Colours.*—Brownish-red. Pectoral fin red externally, with blue edges or emerald green internally, with numerous blotches forming bands. In the *young* the back is reddish-brown, abdomen silvery, sides golden. Dorsal fins reddish, the first being black tipped, the second violet having a dark basal band, and also dark along its upper half. Caudal purplish. Pectoral violet externally, having irregular dark and narrow transverse bands; on the posterior half or two-thirds of its inner side exists a large oval black or very dark blue blotch, on which are scattered small milk-white or light blue spots: these marks gradually disappear in the larger examples. *Habits.*—Usually remains at the bottom in rather deep water, but occasionally rises to the surface.

It lives on crustacea, molluscs, and such small fish as it can capture. It appears to be very partial to shrimps, and has been observed in an aquarium to use the free rays of its pectoral fins in order to disturb them by feeling and poking about. A sordid dragonet, *Callionymus lyra*, has been found inside one, also shells of considerable size.

Means of capture.—The beam-trawl along with other fish; or in salmon nets during the autumn, while they will take a bait.

Breeding.—Couch found their roe enlarged both at Christmas, also during May and July. In January, 1883, I obtained a spent one very much out of condition.

As food.—Is certainly one of the best of the gurnards, while it is often preferred, due to its attaining to a large size. It is rather dry, and is improved by sauce. It is salted in the north of Europe.

Habitat.—From Northern Europe round the British Isles to the Mediterranean and the Adriatic. Most abundant along the south coast, decreasing in numbers towards the north. It is found round Ireland. It attains to at least 14 lb. weight.

4. Grey Gurnard (*Trigla gurnardus*).

Names.—Hardhead; Block's gurnard. In Scotland *crooner* or *croonach* (*croon* "to croak"): *Knoud* or *nowd*, Ireland.

B. vii., D. 8–9 | 19, V. $\frac{1}{5}$, A. 18–19, L. l. 73-76, Cæc. pyl. vii.–ix., Vert. $\frac{11}{24}$.

Length of head $3\frac{2}{5}$ to $3\frac{3}{5}$; height of body 6 in the total length. *Eye.*—High up, situated nearer the posterior than to the anterior end of the head. *Mouth.*—Elongated, its upper profile nearly straight, but most obtuse in the young. Two or three small supraorbital spines. *Teeth.*—Villiform on the jaws and vomer, none on the palatines or tongue. *Fins.*—The second dorsal spine the longest. Pectoral does not quite reach the anal, and is rather shorter than the ventral. *Scales.*—Small. *Lateral-line.*—Armed with about 74 spinous points, most distinct in the young. *Air-bladder.*—Notched at its front-end, causing it to terminate in two obtuse points. *Colours.*—Vary widely, in some no white spots, the upper half of the body being of a slatey-grey, and a black blotch often is present on the first dorsal fin. The white spots on the sides may run into narrow and sinuous lines, or else there may be a dark net-work surrounding light places. *Habits.*—Gregarious, and are said to be the least sensible to variations of the whole of the genus. They are fond of sporting on the surface of the sea, rising and sinking, and uttering short grunts as if of satisfaction. At other times they appear to be asleep on the water.

Means of capture.—They readily take a bait, and are even secured while whiffing at the surface. It is a quiet swimmer.

Breeds.—Probably twice a year, in mid-winter and mid-summer. Their eggs float and are found at some distance from the shore.

As food.—It is good, but very inferior to the red gurnard, partly from its lesser size. It is a good bait for lobster, cray-fish, and even members of the cod family.

Habitat.—Northern Europe, the Baltic, round the British Isles to the Mediterranean and Adriatic. It is the most abundant of our local forms, extending northwards to the Orkneys and Shetland Isles. It is very common along the west coast of Scotland, also round Ireland. It has been obtained up to 2½ ft. in length.

5. The Piper (*Trigla lyra*).

Names.—In Scotland, *crowner* and *sea-hen.*

B. vii., D. 9–10 | 16–17, V. $\frac{1}{5}$, A. 16, Cæc. pyl. vi., Vert. $\frac{11}{15}$.

Length of head $3\frac{1}{4}$ to $3\frac{2}{3}$; height of body $4\frac{1}{4}$ to $5\frac{1}{4}$ in the total length. *Eye.*—Diameter 1 to $1\frac{1}{3}$ in the postorbital portion of the head, 2 diameters from the end of the snout in adults, and $\frac{1}{2}$ to 1 diameter apart. Profile of snout abrupt and concave. Preorbital elongated anteriorly, ending in a broad triangular plate armed in front with several denticulations. Opercle with a strong spine. Coracoid terminates in a long spine almost equal to half the length of the head. The maxilla does not reach to below the eye. *Teeth.*—Fine ones in the jaws and vomer, none on the palatines or tongue. *Fins.*—Dorsal spines strong, the third, which is the longest, equalling half the length of the head. Pectoral reaching to above the seventh or eighth anal ray. *Scales.*—Distinct in large examples. *Lateral line*—unarmed; 25 to 27 spinate elevations along the base of the dorsal fins. *Air-bladder*—oval. *Colours.*—Bright red, becoming lighter on the sides and beneath. Fins red.

Habits.—A wandering fish, sometimes common, at other times rare. When captured it emits a hissing sound by expelling air through its gills. On one being opened it was full of *Ophiuroidea.*

Means of capture.—Usually taken with the beam-trawl.

As food.—It is generally considered excellent.

Habitat.—Common along the south and west coasts of Great Britain, except during the winter months, but owing to its wandering propensities it is often rare at one season and common at another. It is little known in the north, but is said not to be rare about Glasgow. In Ireland it is found on the south and south-west coasts, becoming rare to the north.

It has been observed to attain to about 7 lb. weight.

FAMILY V.—STING FISHES (*Trachinidæ.*).

Geographical distribution.—Cosmopolitan, and but rarely attaining to a large size.

GENUS I.—Weevers (*Trachinus*).

Two species of this fish are found in our seas; the larger or greater weever, and the smaller or viper weever. Wounds inflicted by the spines* of the gill-covers, or those in the first dorsal fin, set up intense agony, which lasts for twelve hours, or even more. No specific poison-gland has been detected, but it has been thought that the virus is a secretion or excretion from the mucous surface of the loose skin which covers the spines, or of its pulpy sheath; such a substance would collect in the grooves, and when these spines penetrated sufficiently deeply into a foreign body, this poisonous excretion would be introduced into the inflicted wound. Even the death of the fish does not at once arrest the virulence of its poisonous properties, as pricks from the spines of dead weevers have been observed to occasion poisonous symptoms. When sea-bathing on sandy coasts or gravelly shores, there is a possibility of the foot of the bather being wounded by one of these fishes if it lives in the vicinity, as such places are its favourite resort, burying itself and leaving merely its head uncovered. Should an unprotected foot be set down near the place inhabited by one of these fishes, it is alarmed and at once strikes against any foreign body with the spines with which its gill-cover is armed, directing its blows with as much judgment as a fighting cock. Many are the instances recorded of injuries inflicted by these fishes, and the intense suffering which they occasion. As a rule the pain appears to subside in about twelve hours, or, as some fishermen imagine, the effects of the poison will continue until the tide returns to the same height at which it stood when the injury was inflicted. Wherever shrimps abound these fish are said to be present, and shrimpers in dark nights have been known to be afraid of picking their captures out of their nets, fearing lest one of these fishes might be among them. Olive oil and opium, locally applied, have been found the best applications.

Geographical distribution.—From the coasts of Scandinavia, through the Atlantic as far south as the Cape of Good Hope; also the Mediterranean. One species has been recorded from Peru.

1. Greater Weever (*Trachinus draco*).

Names.—Weever is asserted to be a corruption of the French term *La vive*, which this fish was called, owing to its surviving for a long period after removal from the water. It has likewise been derived from the Anglo-Saxon *wivere*, "a serpent," the *wivern* being the dragon of heraldry. Rondelet believed it to represent the true dragon of the older naturalists. In Sussex it is locally known as the *sea-cat*, also as *cat-fish* and *sting-bull*. *Sand-eel-bill*, Ayrshire. *Muckle-stanger*, Aberdeen.

B. vi., D. 5–6 | 29–31, V. $\frac{1}{5}$, A. 31, L. l. 78, Cæc. pyl. vi., Vert. $\frac{11}{31}$.

Length of head $4\frac{1}{4}$; height of body $5\frac{1}{2}$ to $6\frac{1}{2}$ in the total length. *Eye.*—5 to $5\frac{1}{4}$ diameters in the length of the head; $\frac{3}{4}$ of a diameter from the end of the snout, and the same apart. Dorsal profile nearly horizontal, that of the abdomen more convex. Cleft of mouth very oblique, reaching to slightly behind the posterior edge of the eye;

lower jaw somewhat the longer. Two small spines at the anterior-superior angle of the orbit; four flat and badly marked ones on the preopercle (sometimes absent), two being on its lower limb, and the anterior of which points forwards. Opercular spine long and strong, enveloped in a loose skin nearly to its termination. *Teeth.*—Villiform in the jaws, vomer, palatine, and pterygoid bones; none on the tongue. *Fins.*—Second and third dorsal spines the longest, six lower pectoral rays unbranched or with the divisions very indistinct. *Scales.*—Cycloid, and passing in oblique rows down the sides of the body. Vent beneath the last dorsal spine. *Colours.*—Grey or yellow, being darkest along the back; brown or bright yellow lines pass down the body in the direction of the rows of scales, decreasing in vividness as they descend; upper surface and sides of the head spotted and reticulated with brown and grey, while blue lines are occasionally intermixed; some yellow stripes along the gill-covers. First dorsal fin black in its upper three-fourths; other fins yellowish, with dark outer edges; posterior margin of the caudal nearly black.

Habits.—Swims near the ground, and sometimes, not invariably, burrows in the sand, leaving only its head uncovered; occasionally it is left in this position by an ebbing tide. It lives upon the fry of fish and small marine animals.

Means of capture.—Beam-trawl, seine-nets, sprat and shrimp nets, or by a baited hook on a deep-sea line. They have been taken in a net floating over thirty-five fathoms of water, but always of a morning, as if they only came near the surface during the darkness of the night.

Breeding.—About June.

As food.—Sold in Whitechapel as food, and known as *Spitalfield weavers.*

Habitat.—From Scandinavia and Western Europe, through the Mediterranean. Also as far south in the Atlantic as the Cape of Good Hope. In Britain it is by no means uncommon along the coasts, more especially the west, but decreasing in numbers towards the north; it is occasionally found on the shores of Scotland. In Ireland it has been taken in Ventry Bay, but not in the north. It attains to at least 17 inches in length.

2. Viper Weever (*Trachinus vipera*).

Names.—*Little*, or *lesser weever*, *sting-fish.* Locally known as *adder-pike*, *black-fin*, *otter-pike.* *Bishoped*, or stung by a *Bishop*, one of these fish in Cornwall. *Stony cobbler*, Youghal.

B. vi., D. 6/21–24, V. $\frac{1}{5}$, A. 25–26, L. l. 65, Cæc. pyl. vi., Vert. $\frac{10}{25}$.

Length of head $3\frac{1}{3}$ to $3\frac{3}{4}$; height of body $4\frac{1}{2}$ to 5 in the total length. *Eye.*—Diameter $4\frac{2}{3}$ in the length of the head, $\frac{1}{2}$ to $\frac{2}{3}$ of a diameter from the end of the snout, and $\frac{1}{2}$ of a diameter apart. No spines above the orbit; two sharp and forwardly directed ones below the angle of the preopercle. Opercular spine strong. *Teeth.*—As in the last species. *Fins.*—Lower five or six pectoral rays unbranched, or with their divisions very indistinct. *Colours.*—Back grey, paler towards the abdomen, where it is tinged with yellow. Reticulated grey lines along the back and top of the head. First dorsal black, with some white lines posteriorly. Caudal with a wide black band along its hind edge.

Habits.—This species is more active and venomous than the preceding one, is similarly captured and used as food.

Habitat.—North Sea, British coasts to the Mediterranean.

Common along the shores of Great Britain, being in some places more abundant than the greater weever; not so common in Scotland, but has been found as far north as the Orkneys. In Ireland most common along the eastern and southern shores, but present from the north to the south. It has been captured up to 6½ inches in length.

FAMILY VI.—MACKEREL (*Scombridæ*).

Fishes of this family are pelagic forms, readily distinguished by their elegant appearance and brilliant colours, while they are mostly highly prized for the table. Carnivorous and exceedingly active, their shapes are well adapted to enable them to glide rapidly through the water; while, to obviate the least impediment, we find in some species depressions existing into which the pectoral fins may be received.

GENUS 1.—The Mackerel (*Scomber*).

Geographical distribution.—These fishes have a very extensive range, being found in most temperate and tropical seas of both hemispheres, but they do not appear to have been recorded from the American shores of the South Atlantic Ocean.

1. Mackerel (*Scomber scomber*).

Names.—*Mackerel*, formerly spelt *Macquerelle; shiners* (young) off the north coast.

B. vii., D. $11\text{–}14/\frac{1}{10\text{–}11}$ + V., V. $\frac{1}{5}$, A. $1/\frac{1}{11}$, Vert. $\frac{14}{17}$.

Length of head 4¼ to 4⅓; of pectoral fin 9⅛; height of body 5¼ to 6¼ in the total length. *Eye.*—With broad adipose lids, the posterior extending to over the hind third of the pupil, and inferiorly being covered by the anterior, which does not reach to the iris, and is attached by its lower edge to the suborbitals ; diameter of the eye ⅕ to ⅙ in the length of the head, 1⅓ diameters apart. The length of the snout is equal to about ⅓ of that of the entire head. The maxilla reaches to beneath the middle of the orbit. *Teeth.*—In a single row in the jaws, in a deciduous patch on either side of the vomer, and in a single or double row on the palatines ; a row likewise at the centre of the base of the tongue. *Fins.*—Dorsal spines weak, the second and third the longest. *Scales.*—Minute, about twenty-one rows between the base of the first dorsal fin and the lateral-line ; along the sides and lower surface of the abdomen they become almost indistinguishable. A keel along either side of the root of each lobe of the caudal fin. *Air-bladder.*—Absent. *Cæcal appendages.*—Numerous. *Colours.*—Upper third of the body green, shot with blue ; while the sides and abdomen are glossed with gold, silver, and purple shades. About thirty-five V-shaped bands pass downwards from the back terminating on or below the lateral-line ; a dark stripe, sometimes interrupted, passes from the base of the pectoral-fin along the side, a short distance below the lateral-line. Fins dark.

Varieties.—The British forms of mackerel have been divided into the commercial species which possesses no air-bladder, and a rare form known as the Spanish mackerel (*Scomber colias*), which is furnished with one ; it has likewise large scales over the region of the breast, and a larger eye. Our commercial form shows great varieties in colour, more especially among those captured along our south and south-west coasts. There is one form in which there are no markings visible along the upper half of the body, or the *unmarked mackerel;* there is another in which the upper two-thirds of the body appears as if scribbled over with short tortuous lines, the *scribbled mackerel;* while a third is marked over with spots and dots, and known as the *dotted mackerel;* all intermediate forms of colour between these several varieties have been found. Mr. Dunn has likewise mentioned that some red-finned varieties exist which the fishermen carefully look for, because on their appearance a plentiful supply is usually off the coast. Disease may likewise change the shape of the bodies of these fish; thus in some forms the vertebral column is twisted into various shapes due to disease; or there may be disease of the oviducts, occasioning an occlusion, and so preventing the eggs being extruded; round these a cyst forms, and when the next season's eggs begin to grow, the shape of the fish becomes entirely altered, being much deeper than natural.

Habits.—Mackerel are a gregarious, wandering, pelagic form of fish, which remains off our coasts throughout the year, and at certain seasons approaches the shores in countless multitudes, prior to, during, or subsequent to breeding; this may, and evidently sometimes is, due to the food they are in pursuit of, or the temperature of the water. Occasionally they forsake their usual haunts; thus from May to July they were formerly abundant off Yarmouth and at Lowestoft, whereas now numbers arrive with the herrings, having deferred their advent to a rather later period of the year, or they may antedate their arrival, as has been observed in some localities. Formerly they were supposed to undertake annually long migrations from the north towards the south at one season, and subsequently the reverse. Lacépède, on the authority of Admiral Pleyville-Lepley, actually asserted that in some small and almost land-locked bays off Greenland, where the water is always clear, and the bottom consists of soft mud, myriads of mackerel might be seen at the commencement of the spring, having their heads inserted several inches into the mud and their tails vertically elevated. He continued that in this manner, and in a state of torpor, they passed the winter, while during the first fifteen or twenty days after their reappearance they were affected by a species of blindness, and could be easily netted, but that subsequently they had to be captured by means of hooks and baits.

During the winter months, or at the commencement of the year, as January or February, these fish begin to move from the deeper portions of the Atlantic towards the British coasts, and in May or June, sometimes earlier, large shoals of spawning fish appear to the south-west of the Scilly Isles, some of which would seem to pass towards the Bristol or St. George's Channel, or Ireland in a north or north-easterly direction; while the largest division appear to go up the English Channel along the south coast of Britain. In mild seasons they are generally taken off Portsmouth in January or February; off Plymouth in 1882 they appeared in January, some being taken in the nets set for pilchards and herrings, but generally a month later they are looked for from twenty to thirty miles from land. A few appeared at St. Ives, in Cornwall, early in January, 1882, and about the middle of that month some fine catches were made in the Bristol Channel. In the middle of February at St. Ives the fishing was being very successfully prosecuted. In March the shoals appeared off the south-west coast of Ireland, where French vessels obtain good cargoes, but which locality is not so much fished by British vessels. At first the ova and milt in these Irish fish was not fully developed, but the supply of fish was continuous throughout April, and near Louphead at the mouth of the Shannon upwards of 20,000 a night were secured by 69 boats. By the end of April the milt and roe were matured. The average weight of these fish was about 2 lb. each. By April the Cornish mackerel began to improve very much in taste, and large quantities were taken on the south coast at Mevagissey. In May the Dover boats brought into Ventnor the first of the season; in July, 1882, they appeared off Poole.

As a general rule, the first mackerel off the Hampshire and Sussex coast are taken in March, or even in February; while off Norfolk their greatest fisheries are in May and June, at which period they also arrive off the Isle of Man. In the Orkneys they are generally present during the last week in July, and in the Moray Firth they come in immense shoals in August.

But in mentioning these fish I must remark that we have two distinct sizes, each of which seems to a great extent to keep by itself; the larger ones, as from 1 lb. to 2½ lb., keeping further out to sea, while the smaller ones come more inshore. The first are absent, as a rule, during the winter, while some at least of the smaller or yearling ones remain during the winter months.

As already observed, mackerel may arrive long prior to their usual period. At Mevagissey, in 1818, 15,000 were taken between February 1st and 12th; in the same month, in 1842, two boats brought into Plymouth 18,000; and in 1843, in the first week in February, from 20,000 to 30,000 were captured each night.

The period at which the arrival of these fish may be anticipated at any particular locality may be somewhat accurately computed by ascertaining at what date they normally appear off certain points, and how long an interval generally occurs between their arrival at one place and their subsequent appearance at a more distant locality.

The number of days these intervals take are generally the same in different years.

In the spring the average size of the mackerel captured off the English coasts is smaller than it becomes during the autumn, owing to some of the shoals being entirely or partly composed of young fish. Their course appears to be very erratic, rising to the surface and approaching the shore, or remaining at the bottom in deep water. But as the summer advances and their food enters sandy bays, these fish follow and are exceedingly active. By the end of September or October, having spawned, the old ones retire to deep water, in which migration they seem to be frequently accompanied by those which were hatched early in the season. Sometimes the half-grown fish, when retiring into deep water at the end of the year, seem to be interrupted in their course, which causes them to remain off the coast during the winter months.

The character of the season or of the weather does not appear to be the sole agent by which the migrations of these fishes are ruled. But it has been remarked that a particular temperature or the direction of the wind has more connection with their swimming nearer to the surface or deeper in the water, probably such influencing the migrations of the animals of which their food is composed.

The food upon which these fish subsist is still a subject requiring investigation. In the month of March, 1882, about 8 miles to sea off Mevagissey, and over 40 fathoms of water, they were found to have been feeding upon a shrimp-like crustacean, *Thysanopoda Couchii*, with which all examined were found to be gorged. When the mackerel midge, the young of the rock-ling, *Motella*, becomes abundant, about the middle of May, these fishes congregate in der to feed upon them. They prey upon members of the herring family, more especially the fry, and during the latter end of summer and the commencement of autumn, "britt," which is the young of the herring or of the sprat, forms a large portion of their daily subsistence along the south and south-west coasts of England. Mr. Dunn at Mevagissey has remarked that some small jelly-fishes (? *Medusæ*) about the size of split peas, and of a dark green colour, appear subsequent to heavy rains, that they are luminous at night and that mackerel prey upon them. Occasionally quantities of the young of the dwarf swimming crabs, *Portunus pusillus*, are taken among these fish along the coasts of Devonshire and Cornwall, and upon which they are supposed to have been feeding; it is well known that they are partial to crustacea, and consume large quantities of the sessile-eyed shrimp-like forms which abound from about February. In May, 1880, a number of these fishes from the south coast were found to be gorged with ova.

They are difficult to keep in an aquarium, due to their impatience at confinement as well as their susceptibility to atmospheric changes. Those selected should be taken by seine-nets, as such as have been meshed are difficult to retain alive, due to the injuries they have sustained. The presence of fellow captives which have been some time previously in confinement has been found to exercise a great controlling power on new comers, which for some time should be kept in the dark.

Modes of capture.—As the January fish obtain a very high price, the fishermen seek the shoals in the earliest time of the year. In the spring the Cornish boats proceed eastward for mackerel fishing, but they net towards the west, thus meeting the shoals. The distance the boats proceed up the English Channel varies in different seasons, while the earliest fish may be expected furthest out to sea.

The quantities captured are liable to great variations in different years; several good harvests may follow one after another, or the reverse may occur; likewise one set of boats may be making large catches while neighbouring ones are scarcely securing a fish. I have already alluded to there being two classes of mackerel, viz., the enormous May and June shoals that come for spawning and consist of large fish, and the more erratic or in-shore and smaller ones that do not appear to keep so well to stated times: the modes of capture of these two classes vary. The nets employed in the English Channel are for the in-shore or smaller forms, the mesh of which before being tanned averages from 27 to 28 half-meshes to a yard; but those employed at the entrance of the channel for the spawning shoals average (untanned) from 21 to 22 half-meshes to a yard.

Early in the spring numerous fishing boats, manned with from five to eight men each, assemble in Plymouth preparatory to the mackerel season, and for the purpose of trying their fortune in the English Channel with drift-nets, which are shot of an evening and usually lifted after two or three hours, but shot again in the very early morning, the best time for carrying on this occupation having been found to be when daylight passes into darkness, or the night into the morning. The fishermen believe that at the commencement of the season the vision of these fishes is not so good as it becomes later on, when, however, it may be materially assisted by lighter days and moonlight nights, while it has been observed that the fat which is found in the early months of the year between the two layers forming the adipose lid to the eye, becomes absorbed as the season advances. It has been remarked that drift-nets are less productive during bright moonlight than when the darker, as the fish are believed to perceive and avoid the net suspended for their capture. In darker weather, however, the mackerel force their heads through the meshes beyond their gill-openings, which precludes their being again retracted. The modes of capture must vary with local circumstances, but generally during the spring and autumn drift-nets only are employed, whereas in the summer, as towards the end of May in Cornwall, these fishes come nearer inland and seines are likewise used. The two may be also in operation at the same time; thus in the first week of July, 1880, both drift and seine fishermen were making large captures off the Cornish coast. At this period a man termed a huer is appointed to keep a look-out for the appearance of the shoals of these fishes, on perceiving which he signals to the fishermen, who at once depart in the direction of the anticipated captures. Mr. R. Couch remarked in the 'Zoologist' that some of the fishermen believe "that if from any cause the eastward migrations pass up mid-channel, the spring fish first appear on the eastern fishing grounds about Brighton, and spawn before they get so far west as the Cornish or Devonshire coasts; hence the eastern fishery is profitable, while the western is a failure. If, on the contrary, they pass up at short distances from the shore, the eastern fishery is a failure and their boats come westwards to take the fish" (p. 1410). The failure of the fishery, therefore, frequently depends upon the fishermen looking for the fish in a wrong direction, and thus they pass unnoticed. They do not rise to the surface during spring and autumn as they do in summer, so their presence has to be detected by nets and fishing; sometimes there are few near shore while they are abundant in the deep water. In September and October mackerel mostly retire to deeper waters, or separate into small shoals, rendering this mode of fishing useless. This, however, is very liable to vary; thus, during the last week in November, 1880, drift-nets were still being employed at Penzance, and took large, fat and well-flavoured mackerel by thousands at night, although usually catches of this sort do not occur after the beginning of June or before the end of February.*

At Rye there is a large mackerel fishery, where fixed nets termed "kettle-nets" are employed, each of which is a little over half a mile in length; the poles to which they are attached being twelve feet high, while each contains three chambers or bights. They commence being used on April 14th, and are continued until the end of November.

Droves of sea-fowl flying above, and every now and then swooping down upon the fish, often give a good indication of where they are, the circling, screaming birds acting as detectives.

When mackerel are in small and divided companies, hand-lining becomes more remunerative than netting, and it has been observed that a greater proportionate success generally attends the employment of several lines used together, while several hooks are best on one line. Those captured by hooks and lines, due to their being less knocked about, generally command a better price in the market than such as have been netted. Although these fish may be taken from a boat at anchor, the favourite time for fishing for mackerel with a bait is when there is a little ripple on the sea, and a light gale is blowing, termed a "mackerel breeze" by fishermen, which takes the boat along at a fair speed under sail, while should the sky be gloomy, so much the better. The plan adopted is termed *whiffing*, *railing*, *trailing*, or *plummeting*. Hand-lining may be carried on at any time during the day, as they appear to feed at all hours, but best in the morning and evening. The line is short but heavily weighted to a cone-shaped leaden plummet; a small line, termed the snood or snoozing, is attached to near the end of the leaded line on one side and terminates in the hook at the other; the bait or lask is wedge-shaped, the thick end being on the hook, while it should take on an undulating motion to resemble a fish.

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* The pilchard season of 1879 ran into January, 1880; while the mackerel season of 1880 commenced in the latter part of January, 1880.—T. CORNISH.

Baits.—When *whiffing* or hand-lining for these fishes, natural baits may be employed, as a slip from the side of another mackerel's tail, termed a lask, a cuttle-fish, a thin rind of pork, or mud-worms. But besides the foregoing, any glistening substance will attract them, as a pearl button, or Hearder's silver spinner, which is an imitation fish fastened on to a silvered plate of copper, and mounted so as to spin freely on a piece of wire. A slip of white kid or a piece of red cloth have likewise been used with good effect; or, stranger still, Ball found about two inches of the stem of a tobacco pipe, put on the line down to the hook, a novel and most successful bait. Fishermen also believe they can entice mackerel from the bottom by various eatable substances, used when the boat is at anchor, as salted pilchards which, having become rancid, are beaten to a pulp and hung over the side of the boat in a basket from which little bits drop.

French mackerel vessels are of a larger capacity than those employed by British fishermen, carry a greater number of hands, and are frequently aided by steam power. The French seek the large shoals of spawning fish, and it is said not to be uncommon for one vessel to obtain upwards of £1000 worth of fish in a single season (while but few English boats are upwards of forty tons burden, and £250 would probably be a very good return for the best of them). They take fish for salting, and consequently do not require to repair so rapidly to port. The captures are preserved on board and packed in the hold, and when the latter is full they return to France.

Having described the modes employed for capturing these fish, a few details are desirable to show their value when brought to market. Yarrell furnishes some interesting figures respecting what obtained during the first quarter of the present century. In May, 1807, the first Brighton boat-load sold at Billingsgate at forty guineas a hundred, or seven shillings each, computing six score to a hundred: this was the highest price ever reached in that market. The next boat-load produced but thirteen guineas a hundred. In 1808 mackerel became so plentiful in Dover that they were disposed of at sixty for a shilling; while in June the same year, at Brighton, a net was so completely filled by them, that it was impossible to drag it ashore; the fish and net in the end sank together. In 1821 the value of the catches of sixteen Lowestoft boats on the 30th of June, amounted to £5252. In 1823, 1,420,000 of these fishes were taken at Yarmouth. In 1844, during October, the Mount's Bay fishermen took 1,400,000, which sold for about £4000. In May, 1868, 300,000 were netted one morning near the Scilly Isles. June, 1869, 10,000 a fortnight were secured at Weymouth, an event which had not occurred for thirty years. Couch gives the average price of mackerel for seven years as from £6 to £9 per thousand; and the numbers taken in a boat of rather less than the average size, with drift-nets, from 15,000 to 24,000. But it sometimes occurs that more than these may be taken in a single night; in fact, at Penzance, drift-nets have frequently brought 100 tons in a single night in May.

Breeding.—In the spring of the year the roe of the mackerel may be observed to be growing very fast, and in Britain it is mostly shed about May, June, or July, at some leagues from the shore and at the very surface of the waves, where a great quantity of these fishes may often be met with engaged in spawning. The ova of these fishes shed in the Brighton Aquarium has been observed to float. A low temperature exercises great influence in postponing breeding, and fish in roe are occasionally seen even in winter. Harmer found 546,681 ova in a female 18 oz. weight, 430,800 in a second of 20 oz. weight, and 454,961 in a third of similar size, all having been captured in the month of June; while Bloch counted 540,000 in one he examined. Mackerel quickly recover from the effects of spawning.

Although this fish is generally a very rapid grower, such must greatly depend on whether suitable food abounds, or the reverse. In Cornwall, where spawning occurs in May or June, young about 3 to 5 inches long are plentiful in the bays about August and September, leaving for the deep sea in November, when they are from 6 to 7 inches in length, and re-appearing the following June about 8 or 9 inches in length. In fact, the young at the commencement of winter are small, and their growth is slow up to the following spring.

Hermaphrodites.—Couch observed upon having noticed these in the form of a lobe of roe lying between the usual pair of lobes of milt; while A. Malm likewise describes and figures such.

Diseases.—The nipper crab, *Polybius Henslowii*, which swims near the surface, has been known to kill mackerel.

The Myxine, a form of sea lamprey, likewise bores into its flesh; and a fish-louse, *Rocinela dannoniensis*, has been taken off a mackerel at Mevagissey. Some hundreds were observed on these fish, and all were found clinging near the pectoral fin, except one which was imbedded near the vent. When half a mackerel is used as a bait, the lice will sometimes in a few minutes scoop out all the fish, leaving nothing but the skeleton and the skin. This year (1882) these fish have been unusually infested with entozoa.

As food.—Mackerel are much esteemed, generally, but not invariably, the moderately sized more than the very large ones; but they taint very rapidly, as well as lose flavour when kept. Some prefer those captured during the autumn and winter months, while others like such as are in roe, taken in May and June, or even July. Those marked with a dark interrupted line along the side are said to be of inferior quality. Owing to the rapidity with which these fish decompose in hot weather, and the consequent deleterious results to consumers, vendors were permitted as early as 1698 to cry them through the streets of London on Sundays, an enactment which does not seem to have ever been repealed. The employment of steam carriers in the place of sailing vessels, and which take the captures from the various boats and convey them rapidly to market, has proved a great gain to all parties, and a boon to the general public. They are usually packed in boxes containing about fifty each for sending to market, ice being added. In June, 1881, Norway mackerel commenced appearing in the markets for the season. They are rather large, and continue arriving for from three to four weeks. This fish was much relished by the Romans, because its internals furnished the precious *garum*, a sort of pickle which gave a high relish to their sauces, besides being medicinally employed, and was said at one time to sell for a sum which would be equivalent to £48 of our present money for two gallons of it.

Habitat.—Extensively distributed in the northern and temperate seas of both hemispheres, and as far south as the Canary Isles. In the Mediterranean the fishery commences at the same time as in the north of Europe, or in the English Channel, or even earlier. They are taken in the Gulf of Lyons from April until August, and in Provence even in May, continuing sometimes until October. At Nice they are said to abound during the spring, and at Genoa are known as April fish. They extend their range into the Black Sea, and during the summer numbers are present, while those of all various sizes appear to breed. They are said not to be found in the Sea of Azof. These fish differ in size and taste not only with the seasons, but also the localities they inhabit. We find that they are finest in the English Channel. They are always rare in the Baltic, although they occasionally occur off the coast of Sweden, as in 1851; but they were small, it taking about three to average one pound weight. Neither do they seem to be always esteemed, at least in Amsterdam; and in the Mediterranean, as a rule, they are dry and inferior in flavour. In the western hemisphere they extend from Greenland to at least as far south as Cape Cod in Massachusetts.

In the British Isles they are most abundant along the south coast, up the eastern shores to Norfolk and Suffolk, and also along the western counties. They appear off the Scottish coast late in the summer, as has been already alluded to under the head of *Habits*.

In *Ireland* they are common round the coast, from Donegal and Antrim, down the east and along the south to Kerry, but are not so abundant along the west as along the east side of the island. Thompson observed in 1836 that in Newcastle, county Down, they were only taken at the latter end of August, while ten miles to the south they had appeared a month previously, this difference being of annual occurrence. The best fishing on the north-east coast commences about July. Rutty remarked that these fish arrive off Dublin in May, and continue for three months.

The ordinary size of mackerel for the table is from 14 to 16 inches in length. Buckland remarked that in the spring of 1879 he received one 18 inches long, and which weighed 2 lb. 11 oz. Mr. Cornish recorded one from Penzance 18⅛ inches long, and 2 lb. 8 oz. in weight ('Zoologist,' 1876, p. 4931). Yarrell mentions one of 2¼ lb. taken at Poulton, in November, 1849, and an example 2 oz. more caught off Hastings in 1856.

FAMILY VII.—HORSE MACKERELS (*Carangidæ*).

The young of many genera of fishes of this family have the head variously armed, but this armature is absorbed before they reach the adult age.

Geographical distribution.—From as far north as Denmark and Sweden, also through most of the temperate and tropical seas of both hemispheres.

GENUS I.—Horse Mackerel (*Caranx*).

Considering the numerous species and varieties of form which are found in the genus, it is not surprising that many subdivisions of it have been proposed. The characters employed for this purpose have been the dentition, form of the fins, the serrations or the reverse of the preopercle, and the armature of the scales on the lateral-line, the scales on the body, and the adipose eyelids. But the single British species is well characterised by its entire lateral-line being armed with large keeled plates.

Geographical distribution.—The fishes composing the genus *Caranx*, or "Horse-mackerels," are spread from Norway and Sweden throughout most of the temperate and tropical seas, more especially abounding in the latter, where they attain to a large size, and are not considered unsuitable for the table, though some have been reported as poisonous at certain times in particular localities in the tropics, probably due to the food on which they have been living.

Scad (*Caranx trachurus*).

Names.—*Scad*, which term is said to denote the inferior quality of its flesh; *rock herring* (Aberdeen); *buck-mackerel* (Banff).

B. vii., D. 8 | $\frac{1}{31-33}$, V. $\frac{1}{5}$, A. 2 | $\frac{1}{26-29}$, L. l. 73, Cæc. pyl. xii., Vert. $\frac{10}{14}$

Length of head 4 to 4½; height of body 5 to 5¼ in the total length. *Eye.*—Situated above the middle of the height of the head; it has a wide posterior adipose lid extending nearly or quite to the edge of the pupil, and also a much narrower anterior adipose lid. Diameter of eye from 3⅓ to 3⅔ in the length of the head, from 1 in the young to 1¼ diameters in the adult from the end of the snout, and nearly 1 diameter apart. The lower jaw the longer; the maxilla reaches to beneath the first third of the eye. Free portion of tail wider than deep. *Teeth.*—Minute in the jaws, also on the vomer, palatines, and in a band along the middle of the tongue. *Fins.*—Dorsal spines weak, increasing in length to the fourth and fifth.

Pectoral sickle-shaped, nearly or quite as long as the head. Second pre-anal spine the strongest. *Scales.*—Very small. *Lateral-line.*—Makes a curve to beneath the first third of the second dorsal fin; in the curved portion of its course it is crossed by large scale-like plates, deeper than wide, which become more indistinct in the adult. In its straight portion these plates, 34 to 40, are keeled, becoming most strongly so posteriorly. The number of these plates is subject to great variation. *Colours.*—Of a dark bluish along the back and so low as the lateral-line, beneath which it becomes silvery, glossed with purple and gold. A diffused black spot on the opercle.

Varieties.—Edward remarks that he once found a rather strange variety of this species in Banffshire. It was about the usual size, but of a most beautiful golden colour, finely striped and variegated with numerous lines of the brightest blue, except the fins, which were of the finest carmine.

Habits.—Adults are more solitary in their habits than are the young, and they swim low in the water. In the colder months they retire to the deep, reappearing on our coasts about April, when they become one of our commonest fish. They are very uncertain in their migrations, perhaps owing to their possessing a great sensibility to cold and vicissitudes of temperature. On February 3rd, 1882 (after a very mild winter), some were present in the Exeter market. Thus Parnell observes that in 1833 and 1834 scarcely an example was observed in the Firth of Forth, while they were in prodigious numbers on the English and Welsh coasts. Off Glamorganshire, on the evening of July 24th, 1834, the whole sea as far as could be seen appeared to be in a fermentation from their numbers. These immense shoals continued passing up channel for week. Devoured themselves in large numbers by sea-birds, they are great enemies to pilchards, the herring-fry, and the sand-launce, &c. Thompson found young *Clupeidæ* in one he opened in August. Ball states that he has seen the "scad" run upon shore in considerable numbers, but whether in pursuit of young sprats termed *scad-bait*, or to avoid porpoises, *Delphinus phocæna*, which were conspicuous in their rear, he was unable to say. In Norfolk, Mr. Upcher observed that he had frequently seen large numbers of the scad in chase of small fry along the coast at Sherringham, and so intent in the pursuit as to be easily taken with a landing net. The beach was quite covered with small fish which were stranded on the shingle after leaping from the water to escape their pursuers. R. Couch has observed that the "mackerel" and "scad" do not intermingle much, except near the Scilly Isles, where they are frequently caught together in large quantities. North of this the mackerel predominate; to the south the scad; and it is surmised that in the winter months the shoals of scad are to the south of those of the mackerel, the borders of the two intermingling. They pass up the channel during the spring in the deep water, feeding at the bottom; but as summer advances they approach the shore, swimming high, and these are frequently taken by mackerel nets, as well as by hooks and lines.

Means of capture.—As many as 20,000 have been taken off Cornwall in a net at one time. In September and October they are captured in numbers in the Cornish pilchard nets. Some are taken in the salmon nets in the Firth of Forth.

Baits.—Large ones readily take a bait.

Breeding.—June, July, and August (but in the Mediterranean during the spring, according to Risso). In September the bays in Cornwall swarm with the young of about 1 inch in length; by October numbers scarcely exceeding 2 inches in length are captured, while others are 7 or 8 inches in length. Scad about 1 inch in length are commonly taken from the stomachs of large fish from the end of December to the middle of February. Couch, from these facts, suggested whether they do not breed twice a year; or perhaps all do not breed at the same time. He also observes that the young have sometimes an unfortunate fate; coming to the surface to obtain heat, they are huddled together, when guillemots dive down to beneath them, and gulls dart down from above.

Uses.—In West Cornwall and the Scilly Isles they are split and dry-salted; also in the north of Ireland, where they are known as *crake-herrings*.

As food.—Pennant says the one 16 inches long, which he had taken in October, was firm and well-tasted, having the flavour of mackerel. It is in best season when it first comes off the coast in April. Generally it is but little esteemed, and is held in no higher estimation in Ireland, according to Thompson; but Ball states that on the south shore it is much valued by the poor.

Habitat.—This fish has been taken off the coast of Denmark and the west coast of Norway, but is not common in the Baltic; as we pass further south their numbers increase, while they are very common in the Mediterranean. Found at Madeira, they range to the Cape of Good Hope, and have been brought from the Chinese and Australian seas; also from Western America, Steindachner having received them from Valparaiso, while others have been obtained on the same coast.

Very common on all parts of the Cornish coast, disappearing in October; but numbers of the young are taken spring. It is found all round the coasts of Great

Britain; frequent off Lowestoft, rare off Yarmouth, while it has been recorded from Berwickshire. In Scotland it has been taken in the Moray Firth; a few every year at Lossiemouth, while it has been met with at Nairn. In the Firth of Forth seldom more than 1 or 1½ dozens are taken during the year. In Banffshire it is not very numerous, and is seldom eaten. It is not uncommon at St. Andrews, and is tolerably common in the Orkneys and Zetland.

In *Ireland* it is taken around the coast, but in larger numbers on the southern and western shores than on the northern or north-eastern.

It attains to about 20 inches in length. Dr. Lowe mentions one he saw taken in the Norfolk estuary which weighed 2 lb.

FAMILY VIII.—(*Cyttidæ.*)

Geographical distribution.—These fishes are found in the temperate and semi-tropical seas of both hemispheres.

GENUS 1.—Doree (*Zeus*).

These fishes have been considered by some ichthyologists as constituting a distinct family—*Zeidæ.*

Geographical distribution.—From Scandinavia to the British Isles and through the Mediterranean; also along the eastern portion of the Atlantic Ocean to the Cape of Good Hope, as well as the Japanese and Australian seas.

1. Doree (*Zeus faber*).

Names.—The Greek name *Zeus* which has been given to this fish appertained also to Jupiter, while the Latin term *faber* was accorded it due to the fancied resemblance many of its bones had to tools used by mechanics. The common term *dory* or *doree*, or *John Dory*, is probably merely a corruption of *jaune dorée*, or "golden-yellow," which has reference to its colour. Superstition, regardless of its absence from the Lake of Gennesaret, has attributed the marks upon its sides to the effects of St. Peter's finger and thumb when he captured one of the finny tribe in order to obtain the tribute-money. This fish was formerly suspended in churches, and the legend of the mark duly detailed and implicitly believed. Some even averred that the spots were elegant representations of the coin which was found. Others, however, thought that, as this fish does not exist in the waters where this miracle was performed, it is unlikely that to it belongs the honour attributed. Another derivation for "John doree" is the name *janitore*, by which it is said to have been known in Venice—a name likewise applied to St. Peter, the keeper of the keys: in short, the door-keeper of a better world. Again, the haddock has been pointed out as possessing two black spots of a similar character, irrespective of which, as in the East numerous fresh-water and a few marine species are thus marked, it seems a rather bold assumption to advocate that this form must be a descendant of the identical species referred to. St. Christopher is also credited with having captured this fish, and left a record on its sides, as shown by the marks on the dory. Another, but more far-fetched, derivation of the origin of the term "*John Dory*" has been advanced, and is that it is a corruption of the Gascon term *Jau*, or a "cock," and that consequently it means "gilt cock," and, as a further evidence, the circumstance that this fish in Southern Europe is termed *gallo*, or "cock," from the crest on its nape. Alston (Zool., 1866, p. 435) observed that in Arran

called *golden haddock*.

B. vii., D. 10/22–23, V. $\frac{1}{6}$, A. $\frac{4}{21-23}$, Vert. $\frac{14}{18}$.

Length of head $2\frac{3}{4}$ to 3; height of body $2\frac{1}{4}$ in the total length. *Eye.*—High up, 1 diameter in the post-orbital length of the head. Mouth very protractile, its cleft oblique, the maxilla being nearly perpendicular when it is closed, and not reaching backwards to beneath the eye; lower jaw the longer, and terminating posteriorly in two spines. *Teeth.*—Finely cardiform, present on the jaws and vomer, but not on the tongue or palatine bones. *Fins.*—First dorsal spines rather strong, gradually increasing in length to the fourth, the interspinous membrane is externally prolonged into filaments of varying lengths; while at the base of each spine is an outwardly projecting spinous process. A double ridge extends from the ventral fin to the vent, armed with eight lateral spines on either side. Second anal spine the longest and somewhat the strongest. *Scales.*—Not imbricate. *Air-bladder.*—Elongated, with the appearance of a slight constriction in its posterior fourth, while a rounded muscular body exists in its anterior fourth, from which passes a tendon. *Colours.*—Olive gray with a yellowish tinge, and usually yellow wavy horizontal bands. In the middle of either side, just posterior to the pectoral fin, a circular or oval black spot surrounded by a narrow yellow ring. Fins gray, in some examples the ventrals are nearly black; in others, two rather dark horizontal bands pass along both the dorsal and anal fins.

Habits.—This fish is somewhat sluggish, and said to be frequently carried along by currents, while in swimming it is usually seen somewhat on one side, which enables it to rest against a rock as well as to see both above and below it. Although its movements are generally slow they become accelerated when it desires food, which it pursues by a sort of succession of jerks. It is a great wanderer, and in the winter months appears to retire to deep water, returning in the spring in excellent condition. It seems to prefer during the warm months rough ground to deep water, as well as sandy bays where weeds and small fishes abound. It has been said to grunt or groan when being removed from the water. It has a very voracious appetite. One which weighed 1 lb. 1 oz. was found to contain eighteen sprats, two sand-smelts, and one cuttle-fish, besides a number of small fish in a decomposed state. From another, 12½ in. in length, Couch took twenty-five "flounders," some of which were 2½ inches in length, three half-grown "father-lashers," and five stones from the beach. It, however, was so gorged that it permitted itself to be taken by the hand.

Mr. Saville-Kent has drawn particular attention to the manner in which this fish uses its fins, the movements of which he, with great justice, likens to that of the dorsal fin in the pipe-fish. This rapid motion affects the soft rays and inter-radial membrane of the dorsal, anal, and pectoral fins, all, or merely some of which, may be in motion at the same time. This may be perceived both when they are ascending in the water, descending, or even when reclining over on one side; but they are likewise able to move their fins more slowly, as generally seen in fishes.

Many cases of *whitlow*, involving the loss of joints of fingers, are occasioned from injuries inflicted by the spines placed at the base of the dorsal and anal fins in these fishes.

Means of capture and baits.—It is obtained most abundantly during summer and autumn, but some are captured throughout the year. It will take a spinning bait; a baby-spinner tagged with a small strip of prepared ray's skin, and a rod with fine tackle has been recorded as killing. One of the best baits is a small fish, especially a young sea-bream, *Pagellus*, hooked by the tail or back. This is swallowed head first, by which means the spines of the bream are said to act like a hook. It will also take pieces of mackerel, pilchard, or cuttle.

Breeding.—Very prolific, and minute young ones are common. I found one full of matured ova in May, 1881; they were very minute and numerous; the young are 2 or 3 inches in length in August.

In the middle of last century a sudden advance in the price of these fish took place. Couch quoted a MS. note as follows:—"Dorys yt used to be sold for three to four pence a piece are now two shillings or half-a-crown a good one." The same author remarks on upwards of sixty, one autumn, being hauled on shore in one ground-seine, the entire lot of which realized nine shillings.

As food.—It is considered by some to be in the best condition for the table during the last four months of the year, but others recommend it as being of superior excellence from January to March, while fishmongers prefer such as are taken from the Devonshire coast. It was much prized by the Romans, who deemed it to be sacred to Neptune. John Quin, the actor, who died at Bath in 1766, when 73 years of age, is commonly reported to have added this delicacy to our tables, and some have even asserted that so pleased was he with it that it was commonly known as *John's dory*. Borlase, in Cornwall, 1755, remarked, "This fish is of firm substance and much coveted, but rather dry in comparison of the sole and turbot." Sir J. Banks placed it among "the most valuable of fishes, as it required no sauce." Some good judges of eating rank it next after the turbot.

Mode of cooking.—They are somewhat improved by not being cooked for two or three days after their capture; they are boiled very slowly, and Quin recommended that this should be done in sea-water.

Habitat.—Has been taken as far north as Norway; seems to be absent from the Baltic, but extending southwards towards the British shores, where it increases in numbers; it is also found along the Atlantic coasts of Europe, as well as throughout the Mediterranean.

In Great Britain it is common along the south and west coasts, becoming rarer proceeding towards the north. At Hartlepool, Hogg recorded its occurrence in February, 1860, observing that it had not been taken there previously. Paget mentions its capture at Yarmouth, and Johnston off Berwickshire, and Southwell off Sherringham.

Parnell informs us that in the Firth of Forth seldom more than one or two are captured during the course of a year; it is rather rare at St. Andrew's, but not uncommon as a summer visitor in Banffshire, where it is mostly taken in the salmon nets.

In Ireland it is found all round the coast, but sparingly in some localities. Thompson says that their numbers increase northwards, and he was credibly informed that about twenty are taken in the vicinity of Portrush for one in Belfast Bay.

In August, 1879, one at Norwich, which weighed 14 lb., was recorded in *Land and Water.* Couch mentions another, 22½ inches in length, which scaled 18 lb.

FAMILY IX.—SAND SMELTS (*Atherinidæ*).

Geographical distribution.—These pretty little fishes, furnished with a burnished silvery lateral band, are distributed throughout nearly all the seas of temperate and tropical regions. They are not only taken in the littoral zones, but even in estuaries and tidal rivers when not far removed from the sea, while some have been acclimatised in fresh waters.

GENUS 1.—Sand Smelt (*Atherina*).

These are gregarious fishes mostly residing in the littoral regions.

Atherina presbyter was reported by Meynell in 1844 as taken in Bridlington Bay, Yorkshire. Montagu and Yarrell considered it absent from the east coast of England, where its place is filled by the true smelt, *Osmerus eperlanus*, which in its turn is asserted to be absent from the south coast. The foregoing, it would appear, cannot be accepted as literally correct if Gurney, who has reported it from Lowestoft, and Lowe, from the Norfolk estuary, have not likewise been in error. It is evidently rare on the east coast, which may be due to the nature of the ground or absence of appropriate food. In the *Field*, May 21st, 1881, it is observed, "Sand-smelts run larger in Cornish deep-water harbours than further east, as a rule."

1. Sand-smelt (*Atherina presbyter*).

Names.—Smelt, or *sand-smelt*, where the true *Osmerus eperlanus* is unknown. A local name is *silver-sides*, from its colour. In Cornwall it was formerly termed *Quid*, a word signifying "white"; *Pincher* at Portrush (Ogilby); *Portaferry chicken*, north of Ireland (Thompson).

B. vi., D. 7–9/$\frac{1}{11-13}$, V. $\frac{1}{5}$, A. $\frac{1}{14-18}$, L. l. 57–62, L. tr. 10–11, Vert. 51.

Length of head $5\frac{1}{2}$ to 6; height of body $5\frac{3}{4}$ to $6\frac{2}{3}$ in the total length. *Eye.*—Diameter $2\frac{3}{4}$ to 3 in the length of the head, ¾ to 1 diameter from the end of the snout, and 1 diameter apart. Cleft of the mouth oblique, the posterior extremity of the maxilla reaches to beneath the first third of the orbit; the lower jaw somewhat projects in front of the upper. *Teeth.*—Present in the jaws, vomer, palatines, and in a median patch along the tongue. *Fins.*—The first dorsal commences over the middle of the ventral fins, its second and third spines longest, equalling the highest rays of the second dorsal, and ⅔ of the height of the body below it. The second dorsal commences above the sixth anal ray. Cœcal appendages absent. *Colours.*—Semi-diaphanous, of an olive-brown along the back, becoming silvery tinted with purple on the sides and beneath. Numerous fine black dots along the edges of the scales in the upper half of the body. A burnished silvery band, darkest superiorly, extends from the eye to the centre of the base of the caudal fin; it occupies the lower half of the fourth, the whole of the fifth and the upper half of the sixth row of scales in the anterior region of the body.

Varieties.—In form: Jenyns found the eye in some examples having fifty-one vertebræ, 2½ diameters in the length of the head. *As to colour:* Thompson observes that the atherine of the north of Ireland differs from the English specimens in being of a darker, and consequently a less sandy colour.

Habits.—This appears to be rather a local species, generally living in small communities along the shores, or in harbours or bays where the ground is rough and sandy, and the water smooth, retiring in winter to deeper water. Couch remarks that he had been informed of instances in the shallow waters of a harbour where numbers which had been surprised by a sudden frost had been left dead on the shore. It eats small crustacea and vegetable matter.

Means of capture.—Nets of about 30 yards long and 18 feet deep, made of fine twine and having a small mesh. One end is held by a person on shore, while another in a boat has the other end. The net is thus dragged at the surface of the water parallel with the shore, or encircling a portion of a bay or of the shore. At Portsmouth Yarrell describes another mode of capture. A concave circular net is suspended from an iron ring of 4 feet in diameter, kept horizontal by a three-slip bridle. The net is lowered steadily in 8 feet of water among the timber floating on the side of the harbour nearest the dockyard. Pounded crabs sprinkled over the net is the attraction; and the net is occasionally raised to the surface. A nearly similar plan is employed, according to Buckland, at Lymington in Hampshire, where a man dips a circular net suspended from a pole into the water; he then baits it, and finally raises it by using the side of the boat as the lever for the pole. They readily take a bait when assembled at the end of piers.

Bait.—Ogilby states that at Portrush it is only caught by fishing with a small hook, baited with a piece of the flesh of the *Galeus canis*, that of every other dog-fish being refused. In Cornwall it is found to take a bait readily; in fact, along the south coast it is captured by anglers from projecting points in several localities, and observed to be so taken even when heaviest with roe.

Breeding.—July.

Uses.—A good bait, especially for haddocks.

As food.—Some have deemed it a well-flavoured fish, but rather dry and inferior to the true smelt, and best when in full roe. Others consider it worthless as food, and full of bones.

Habitat.—This species extends from the north-east coast of Scotland; very sparingly along the east shores of Great Britain, but abundant on the south. It is also found on the Atlantic coasts of France and the Iberian Peninsula, and has been reported from the Mediterranean.

This fish has been recorded at Aberdeen, St. Andrew's, where it is rare, but one local specimen exists in the museum; in the Firth of Forth it is sometimes washed ashore after easterly winds, but is usually rare. It is recorded from Bridlington Bay, Yorkshire. In the Norfolk estuary it is said to be frequent during the summer months, and found at Lowestoft. In Kent the atherine appears to be unknown, but is extremely plentiful in Hampshire, especially about Southampton. On the south coast of Devonshire it is caught in great abundance in the creeks and estuaries, but never in rivers above the flow of the tide. It appears to continue near the shore through the months of autumn to spring. It is found in Kent, along the coast of Sussex; throughout the year, except during frosts, at Southampton; is as plentiful on some parts of the southern coast of England as the smelt is on the eastern coast, and each seems to have its limits.

Ireland.—Found in certain localities from the coast of Down, where it is plentiful, southwards to that of Cork, being not uncommon at Wexford and Youghal. It is mostly brought to market at Belfast from December to April, both months inclusive, but has been observed as early as September. In autumn it is very common in the harbour at Portrush, county of Antrim. Dingle Harbour abundant. Said to attain a larger size in Ireland than in England. In Strangford Lough its average length is recorded at 6¼, a few 7, and one 7¼ inches long.

FAMILY X.—GREY MULLET (*Mugilidæ*).

Geographical distribution.—These cosmopolitan fishes are found in most temperate and tropical seas, where they frequent the shores, and ascend the larger rivers even into fresh water. Some forms appear to be entirely restricted to fresh water.

GENUS 1.—Grey Mullet (*Mugil*).

Respecting the mullets which live in the British seas, some differences of opinion exist. Irrespective of *M. curtus*, Yarrell, Thompson and Couch merely recognised two, *Mugil capito*, a "thin-lipped" species, and *M. chelo*, a "thick-lipped."

Mullets have frequently been kept in large salt and even fresh-water aquaria. In 1831, Mr. Arnold, of Guernsey, communicated to the Zoological Society of London some experiments which he had personally carried out on this subject, in a five-acre lake of varying depths, having a muddy, gravelly or rocky bottom, and which was principally filled with fresh water. Here for nine months in the year cattle came to drink, but in summer the water was too salt, due to a supply from the sea being received through a tunnel. Among the introduced fish were grey mullets, which, it was remarked, bred as freely as if they had remained in the sea. At Devonport exists a most beautiful piece of water, on the three sides of which trees come down to its edge; a small stream flows in from the high lands above, while at its lower end a tunnel communicates with the backwater, and through which saline water obtains an entrance. A long weir prevents the entrance of fish into, or exit from, this lake. Here are many mullet, which the owner has had netted and introduced during the last few years, and where they appear to flourish.

These fish are very active, and as soon as a shoal is enclosed by a net, they at first lose all order, but this soon becomes re-established, and a leader seeks for a hole or way beneath the obstruction, or, failing this, they essay to spring over. At Mevagissey a shoal entered the harbour, and having been perceived, the entrance was at once barred by nets. The mullet first tried to jump over, but a net was raised to bar that route. The water was very clear, and the fish were seen to swim round and round, to try to find an exit. Next they attempted to get under the foot-rope; at last one made a push, but became meshed. When this was done, another came and laid beside it, and nothing could drive it away. In short, all escaped but these two. Carew had a pond of salt water in Cornwall, in which mullets were kept, and having been accustomed to feed them at a certain place every evening, they became so tame that a knocking like that of chopping caused them to assemble.

There are two points of great interest in the internal anatomy of these fishes which must not be passed over in silence; the first being how they feed, and the second the conformation of their stomachs. In an aquarium it is most interesting to observe them suck in the sand, the coarser portion of which they almost immediately afterwards expel from their mouths. A sifting or filtering apparatus exists in the pharynx, which precludes large and hard substances from passing into the stomach, or sand from obtaining access to the gills.

The œsophagus passes into the cardiac portion of the stomach, which forms a blind sac; while the pyloric portion is conical externally, somewhat resembling a bird's gizzard, but which, when cut into, is found to consist of dense muscular walls, formed of circular fibres, leaving a small cavity internally, lined with a thick and horny epithelium. The pyloric opening is protected by a valve, and here are seen the orifices of the cæcal appendages, which usually encircle the commencement of the small intestines.

Mullets are much esteemed as food, but perhaps more so on the continent than they are in Great Britain ; while such as have been taken in clear streams are much better flavoured than those captured in the ocean ; any that have been resident in stagnant pools where reeds abound, or where the bottom is foul and oozy, are generally to be avoided. They ought to be cooked the same day they are captured. Large numbers are exported to France from Great Britain.

Before cooking they must first be very carefully eviscerated and cleansed, as they are not always very particular as to the food they swallow.

In Italy the hard roe of mullets is converted into cakes termed *botarge* or *botargo*, which are prepared by washing, sprinkling with salt, and pressing between two boards. This may be smoke or sun-dried, and is considered a good appetiser to promote thirst. But in India the same article is somewhat similarly treated, and considered excellent for curries.

The modes of capture adopted for taking mullets are numerous. Thus, at Naples, when these fishes are surrounded by a net, the fishermen first set to work to terrify them, which is accomplished by making a great disturbance on the surface of the water ; or else they place a raft composed of reeds round the outside of the nets, so that the mullets which spring over are captured by persons stationed outside for that purpose. In a nearly similar manner some of the fishermen on our own coast scatter straw on the water on the inner side of the net; on to this the fish throw themselves, but only to fall again into the inclosure, while it is believed that, having once failed, they give up further efforts at escape.

1. Grey Mullet (*Mugil capito*).

Names.—Thin-lipped mullet. Mowed (Halliwell).

B. vi., D. $4 \mid \frac{1}{8-9}$, V. $\frac{1}{5}$, A. $\frac{3}{8-9}$, L. l. 42–46, L. tr. 14, Caec. pyl. vi–viii.

Length of head 5 to 5½; height of body 4½ to 5¼ in the total length. *Eye.*—Without adipose lids; the diameter 4½ to 4¾ in the length of the head, 1 to 1¼ diameters from the end of the snout, and 2 to 2½ apart. Upper lip not thickened. Angles made by the anterior edges of the mandibles a little obtuse; width of the gape of the mouth nearly equal to three times the extent of the cleft; mandibles broad; the end of the maxilla visible behind and below the angle of the mouth. Preorbital very finely serrated at its external edge. The free space on the chin narrow, and reaches to nearly opposite the hind edge of the preopercle. *Teeth.*—Fine labial ones in upper jaw. *Fins.*—First dorsal commences either nearer to the snout or midway between it and the base of the caudal fin; its spines are of moderate strength, the two first being of about equal height, and not quite equalling half the length of the head, the interspace between the two fins being equal to 1¾ or twice the length of the base of the first dorsal. Pectoral inserted some little distance above the centre of the depth of the body, and its length equalling that of the head, excluding the snout. Anal commences somewhat in advance of the second dorsal. *Scales.*—24 or 25 between the snout and the spinous dorsal; about 6 in the interspace between the dorsal fins. No large pointed axillary scale. The pectoral fin reaches to about the 11th or 12th scale of the lateral-line. The first dorsal commences above the 13th or 14th scale of the lateral-line, and the second above the 26th. No scales on the second dorsal or anal fins ; a long angular one at the base of the ventral. *Colours.*—Silvery, becoming lighter below ; six to eight dark bluish bands along the rows of scales of the back and sides ; head shot with golden ; fins grayish.

Habits.—Couch observed that it never goes far from land, but delights in shallow water during the warm weather, snatching at any oily substance that may chance to be floating about. It ventures some distance up rivers, returning with the tide, and frequently enters by the floodgates into a salt-water mill-pool at Looe, which contains about twenty acres. It selects soft and fat food, or such as has commenced to decompose, and is especially partial to shrimps.

In autumn and winter these fish are very plentiful and gregarious. They are more active than *Mugil chelo*, and when enclosed in a seine they jump much higher. During October and November, 1880, I examined many obtained from Brixham and the coasts of Cornwall, and all belonged to *M. capito*, as described.

Means of capture.—Netting, and rarely by hooks ; but it is as active at escape as the *M. chelo.* It sucks at its food, and will occasionally take a rag-worm or artificial fly. In the Stour it is observed that slimy stuff, which after a drought rises most freely from the bed of the river, will stick to the hook, and no other bait equals it. Couch says that it is most readily taken with bait formed of the fat entrails of a fish, or cabbage boiled in broth. It is angled for as the tide is coming in, for on the ebb it returns to salt water.

Breeding.—Said to be in the winter months, but on opening some on January 27th, 1882, I found the ova not nearly ripe, while the winter had been very mild.

Habitat.—This species would seem to be very rare on the coast of Norway, but was possibly the form captured off Denmark in the Cattegat, October 8th, 1852. Occasionally taken on the shores of the German Ocean, becomes more numerous along the south and south-west coasts of Great Britain, and the Cape of Good Hope. It extends through the Mediterranean to the fresh-water lakes of Tunis, and in the Nile certainly as far as Cairo.

In the British Isles some confusion respecting its distribution exists. Many of the recorded Scotch examples may belong to *M. chelo*, but the British Museum has received specimens from the Firth of Forth. It would seem to be occasionally taken off the Yorkshire coast, where it is said to be resident and local. I have obtained many examples, but all from the south and south-west coast, captured between the months of September and March inclusive. It occurs constantly on the Kentish and Essex shores.

In Ireland this species was not found by Thompson, who, however, only had the opportunity of examining mullets from the east coast. In the Cork Fauna (1845), Dr. Harvey gives *M. capito* as certainly present, and *M. chelo* with doubt.

This fish exceeds 3 feet in length.

2. Lesser Grey Mullet (*Mugil chelo*).

Names.—Thick-lipped mullet.

B. vi, D. $4/\frac{1}{8}$, V. $\frac{1}{5}$, A. $\frac{3}{9}$, L. l. 43-45, L. tr. 15-16, Cæc. vi-vii, Vert. $\frac{11}{13}$.

Length of head 4¾ to 5; height of body 4⅓ to 5 times in the total length. *Eyes.*—Without adipose lids; the diameter of each 4½ in the length of the head; from 1 to 1¼ diameters from the end of the snout, and 2½ apart. Snout obtuse; upper lip rather thick, with two or three rows of papillæ on its lowest portion; while in others there are several but much smaller rows, perhaps due to season. Angles made by the anterior edges of mandibles obtuse, the extent of the gape of the mouth being about three times as wide as the depth of its cleft; mandibles very broad; the end of the maxilla visible behind and below the angle of the mouth. Preorbital obtusely truncated, posteriorly coming to a point; its lower edge, which is somewhat rounded, being finely serrated. A narrow strip of the chin is uncovered. *Teeth.*—Fine labial ones in the upper lip. *Fins.*—The dorsal commences somewhat nearer the caudal fin, or midway between it and the end of the snout; spines stout, the two first of the same height, and equalling that of the postorbital length of the head. The interspace between the two dorsal fins equal to or slightly exceeding that of the base of the first dorsal. Pectoral inserted somewhat above the centre of the depth of the body, and its length equalling that of the head, excluding the snout. Anal below the second dorsal, and rather higher than it. *Scales.*—About 26 between the snout and the base of the first dorsal fin. The second dorsal commences above the twenty-ninth scale of the lateral-line; the pectoral reaches the tenth or twelfth, and has no elongated angular scale at the axilla; while such is present at the base of the ventral and first dorsal. A few scales on upper part of the preorbital and the anterior edge and base of soft dorsal and anal fins. *Colours.*—Grey shot with bronze about the head, cheeks golden, sides silvery dashed with gold; a dark line along each row of scales on the back and sides.

Habits.—Gregarious, frequenting harbours, mouths of rivers so far as the tide extends, inlets of the sea, and but rarely enters deep waters. Is a summer visitant to the Humber estuary, is rather uncertain in its movements, but generally appears in May, and leaves in August. It seems to delight in the most oozy parts of bays, and where the grass-wrack, *Zostera marina*, abounds.

Breeding.—Young mullets are first seen off Cornwall late in July, and generally near the surface. About August schools of young mullets (each of which measures about three-quarters of an inch in length) are present along the south coast. I received one 1¼ inches long taken March 20th, 1882, in Cornwall, and several up to 3¼ inches in length captured the same week near Exeter. While swimming each appears to have a white spot on the back of its head, which disappears on its being removed from the water. Thompson, in Ireland, did not obtain any in spawn from March until September.

As food.—Esteemed for table. The county of Sussex is celebrated in a gastronomical point of view for six things—a Chichester lobster, a Selsey cockle, an Arundel mullet, a Pulborough eel, an Amberley trout, and a Rye herring—the mullet referred to being this species, according to Yarrell.

Habitat.—Coasts of Scandinavia, the German Ocean and Atlantic coast of Europe to Madeira, and also the Mediterranean.

In the Orkneys and Zetland the thick-lipped grey mullet is tolerably frequent from June to September, and is the common species on the eastern shores of Scotland, where M. *capito* is not known, or is at least far from numerous.

It is common on the west coast of Scotland, and in some seasons numbers are taken off Dunbar. It is found at Aberdeen, and has been noticed off Berwick. Occasionally taken on the Yorkshire coast. Plentiful at Portsmouth, and during July and August until October in Devonshire, Plymouth and Penzance.

In Ireland it frequents the east coast from north to south ; it also frequents the south coast.

It attains to upwards of 3 feet, and one is recorded from Ireland weighing 14¾ lb.

ORDER II.—SPINELESS FISHES (*Anacanthini*).

All the fin rays of the vertical and ventral fins articulated: ventral fins, when present, jugular and thoracic. Air-bladder, if existing, not having a pervious pneumatic duct.

The order of spineless fishes has been divided into two groups, in one both sides of the head are symmetrical, in the other not so.

First group.—*Anacanthini Gadoidei.* The two sides of the head symmetrical.

FAMILY I.—COD-FISHES (*Gadidæ*).

Geographical distribution.—The cod family is composed of surface and littoral forms, those residing off our coasts having been found at a depth rarely exceeding 120 or 150 fathoms. These fishes are extended through the Arctic and temperate regions of the northern hemisphere, becoming almost unknown in the tropics, and very rare to the south of the line. Although, as a rule, it is composed of marine genera, still fresh-water representatives are not unknown, as the burbot, *Lota vulgaris*, which would seem to be descended from a marine ancestry, for, like its ocean relatives, its air-bladder is destitute of ossicles connecting it with the internal ear. Reliable evidence confirmatory or the reverse of this view, or whether marine residents among the Gadidæ may be detected living in fresh waters, thus becomes desirable. For should a migration from the sea to fresh waters be undertaken without occasioning deleterious results, it would tend towards confirming the possibility of the correctness of the foregoing deduction.

In Midgulen Lake, 61° 43′ N. Lat., and 5° 15′ E. Long. from Greenwich, pollack have been found living in the fresh water. This lake is about 500 yards from the sea, with which it is connected by a river averaging about 20 yards in width by 3 feet in depth. There are no falls, but three or four rapids, which at high water are (as regards those nearest the sea) submerged, the upper ones being but slightly affected. A small boat could perhaps row from the sea into the lake under favourable circumstances, while the strength of the current could not prevent a fish of the weakest sort from entering the lake; at the same time no sea-water can get in—the more so that the head of the Fjord itself is fresh on the surface. This lake is about one and a half miles in length, its depth unknown; it is fed by the snow melting on the hills far and near, while its water is perfectly and entirely fresh. Here reside the usually marine pollack. On the south side of the Sogne Fjord, about thirty or forty miles from the sea, is a Fjord called Fuglesœt, a small branch of which is the Sörejde Fjord. Here a small river, about one hundred yards long, flows from the lake to the sea, which, though rapid at low water, is nearly checked at high water. Still the fresh water always pushes out. This lake is two miles long, and fed by two snow streams. Here cod, coal-fish, and pollack may be taken at the inland extremity of the lake, the pollack being actually in the snow-water stream. There is no sign whatever of fresh-water fish. In short, the sea-fish have complete possession of this lake, which is entirely fresh.

Marine fishes in the Baltic have become acclimatised to a residence, where the character of the water has gradually changed from saline to fresh, so that the herring and some other sea forms, unable to obtain access to the Arctic Ocean, deposit their eggs in potable water, and the four-horned *Cottus quadricornis* even migrates to the rivers. Both the foregoing instances show how marine Gadidæ may voluntarily enter and reside in fresh waters, while we have no reason to suppose that, were their return to the sea cut off, they could not live and continue their species in this new locality.

These fish, especially the cod, occasionally shift their ground, some cause, probably absence or presence of some peculiar food, inducing them to leave localities they had previously frequented ; thus the London market used to be supplied from the Orkneys and the Dogger Bank, but during the present century these fish have extended their range to off Lincolnshire and Norfolk in sufficient numbers to render their capture remunerative.

Fisheries for cod have existed in the north many centuries, for we know that one in the German Ocean was recognised before A.D. 1368, because in that year the city of Amsterdam obtained permission from the King of Sweden to form an establishment in the *island* of Schonen for the purpose of carrying it on. But prior to John Cabot's re-discovery of Newfoundland in A.D. 1496 the fisheries of the greatest importance in Europe were off our western isles and the coast of Ireland. English fishermen must have resorted to these latter localities prior to A.D. 1415, because we read that Henry V. was disposed at this period to accord satisfaction to the King of Denmark for certain irregularities committed in those seas by his subjects. But since the commencement of the sixteenth century the Newfoundland fisheries have become the most important in the northern hemisphere. Cod fisheries, frequented by British fishermen, exist to a greater or less extent from Iceland to the south coast of England, and as far west as Newfoundland. They are largely carried on in these islands, especially to the north and west of Scotland, and likewise off the maritime counties of Ireland.

Means of capture.—The cod, or white fishery, in which is here included the common cod, haddock, whiting, bib, pollack, coal-fish, ling, hake, torsk, and their family allies, is one of great national importance in several ways, more especially as the means of obtaining a large amount of good and wholesome food, as well as giving employment to fishermen and many traders. The members of the cod family are generally gregarious, and collect in large shoals at particular spots, and although in the following observations the common cod will be more especially mentioned, their fisheries are representative ones of what is likewise being carried on to secure other members of the family. The three forms which are, perhaps, the most valuable in an economic point of view are the common cod (*Gadus morrhua*), haddock (*G. æglefinus*), and whiting (*G. merlangus*). The common cod as a rule is in the best condition from the end of October to the beginning of February, the cold season being that in which members of this family attain the greatest perfection for the table, although some are employed for this purpose throughout the year. Living as the cod does, it is found feeding mostly near the ground on submerged banks, where it can obtain appropriate food. Being a voracious feeder, the experienced fisherman takes advantage of its appetite, and with long or hand-lines, as well as nets, seeks his game in suitable localities. *Long-lines* or *bulters* are employed up to at least seven miles in length, while the Norwegians also use *trawl-lines* and even nets. The baits employed are various:—small fish, as lamperns (*Petromyzon fluviatilis*), sand-launce (*Ammodytes*), herrings (*Clupea harengus*), pilchards (*C. pilchardus*), sprats (*C. sprattus*), whelks, or buckies as they are termed in Scotland, where they are much approved of, due both to their toughness and likewise attractiveness to the cod and ling, limpets, mussels, various crustacea, and testacea, as well as lug-worms, and even the roe of the cod itself. These lines, if slightly raised off the ground by floats, or buoyed at both ends, so that merely the middle portion rests on the ground, cause the bait to be less hidden by weeds, are better seen by the fish, and less consumed by crabs and star-fishes. The long-lines off our coasts are shot about slack water, and heaved up in about six hours, when the tide has nearly finished. Sharks, dog-fishes, and porpoises are great enemies to this occupation, carrying away the hooked fish. *Hand-lining* is used very similarly to long-lining, only employed by men fishing from boats, while it is most efficacious when cod are not at the bottom, but rising more towards the surface, as when in pursuit of the herring or other fishes. *Whiffing*, or surface line-fishing, and *beam-trawling*, are likewise employed for taking some members of the cod family.

The fish having been captured, the question for the fishermen is, if they shall be killed at once and prepared in a suitable manner by means of ice or salt for a near or distant market; or whether they shall be retained alive by being placed in appropriate places. Smacks with wells in them were first used in England at Harwich, about A.D. 1712, said to have been copied from some Dutch fishing boats. This well, as now made, is not simply a tank fitted into the smack, but a constituent portion of the vessel itself. Two strong and water-tight bulkheads are constructed across the width of the smack, enclosing a large portion of the centre of the vessel, while they reach in height from the deck to the keelson. Large holes are bored through the sides of the smack below the water-line, permitting a constant stream being kept up. Here cod captured at a moderate depth will live for a considerable time, but should they or ling have been hooked at a great depth, they will not usually thrive. Rough weather is very detrimental to fishes in welled smacks, occasioning many deaths. A plan is likewise adopted for keeping cod alive after arriving in port, by transferring them to cod-chests, which are kept floating in docks or other suitable places. Those at Grimsby and Harwich are about 7 feet long and 2 deep, the bottom and sides being made of stout battens, placed a short distance asunder in order to admit a constant penetration of water from outside. The top is planked, but possesses an oblong opening and movable cover for introducing or removing the fish. To the ends of each cod-chest ropes or chains are attached in order to easily move it about. About forty good-sized cod will live about a fortnight in one of these chests, and about four hundred are constantly in use at Grimsby. For sending to market, the cod are removed, killed by blows on the head with a mallet or short club, and then sent to London, where they are known as "live cod," and attain the highest price. Owing to the method employed in killing them, they can be crimped some hours subsequently.

Diseases.—The members of the cod family appear to be very susceptible to disease, especially of the vertebral column, which may become shortened, and has been compared by Dr. Dyce to a form of rickets, occasioning angular or lateral curvature. This may cause a diminution in the extent of surface covered by the dorsal or anal fins, which from this, or other causes, vary greatly in the number of their rays. Sometimes it gives the fish a hunch-backed appearance, or the proportionate length of the head to that of the body becomes far greater than is normally the case. Blindness is not rare among these fishes, especially when in confinement. The presence of parasites may not only alter the colours of the fish as shown by its being of an unnaturally light tint, but also by the infected spots turning black, as seen in the speckled cod.

GENUS I.—The Cod (*Gadus*).

The reason why these fishes were termed *Asinus* by the ancients has by some been considered to have reference to their colour; while others believe it to be due to their having been carried to market on the backs of asses. Yarrell, however, advanced another suggestion, that the term was originally intended for the *haddock*, in which (he says) the shoulder blotch frequently extends over the back, uniting with that on the opposite side, and thus reminding the observer of the dark stripe over the withers of an ass. A slight objection might be raised as to whether it can be considered probable that the Greeks and Latins conferred this term on a species which does not exist in their seas. The name has also been supposed to refer to the hake.

This genus was subdivided by Cuvier into (1) those in which three dorsal fins and a submandibular barbel were present, *Gadus;* and (2) those in which the barbel was absent, *Merlangus.*

A. *Upper jaw the longer; its outer row of teeth enlarged* (*Gadus*).

a. *Barbel present.*

1. Cod (*Gadus morrhua*).

Names.—*Poullach,* Moray Firth, or if half grown, *duncan* (Gordon); *kleg* and *keeling,* a large kind of cod; also *chelynge* (Halliwell). *Dole-fish* is that form in which the fishermen of the North Sea had their pay or "dole." *Blens,* while the young are generally known as *codlings.* In the Channel, those the size of a whiting are termed *codlings* and *skinners;* when larger, *tumbling* or *tamlin-cod* (Yarrell). *Haberdine* or *salted cod* in Westmoreland.

B. vii., D. 13–15 | 16–19 | 17–19 (21), V. 6, A. 17–19 | 16–18, Vert. $\frac{19}{32}$.

Length of head $3\frac{2}{3}$ to $4\frac{1}{2}$; height of body 4 to 5, or even more in the young, in the total length. *Eye.*—Diameter, $4\frac{1}{4}$ in the young to 7 in the adult in the length of the head; $1\frac{1}{2}$ diameters in the young to 2 in the adult from the end of the snout, and $1\frac{1}{4}$ in the young to 2 in the adult apart. Body much thickest anteriorly. Mouth wide, with a deep cleft. Upper jaw the longer; the posterior extremity of the maxilla reaches to beneath the first third, or middle of the eye. A barbel, generally as long as the eye, but sometimes shorter, is situated below the chin. *Teeth.*—Cardiform, with an outer and much enlarged row in the upper jaw, in a V-shaped patch on the vomer, absent from the palatines and tongue. *Fins.*—The first dorsal somewhat triangular, it commences over or slightly posterior to the base of the pectoral. There exists a very short interspace between the bases of the two first dorsal fins. A very short interspace exists between the second and third dorsal fins, and a longer or shorter interspace occurs between its termination and the base of the outermost caudal rays. The anterior anal fin commences on a vertical line below the fourth or fifth ray of the second dorsal, and a short interspace exists between it and the origin of the second anal, which is similar to the third dorsal. Vent situated on a vertical line beneath the first rays of the second dorsal fin. *Cæcal appendages.*—Numerous and short. *Colours.*—Greenish or grayish, or olive, and occasionally covered with yellow or brown spots along the back and upper two-thirds of the body, its lower portion pure white. Lateral-line white, especially in its lower half. Fins gray, becoming darkest towards their outer edges.

Varieties of form.—Fishermen distinguish two races: (1) the southern or Dogger-bank cod, having a pointed and somewhat elongated snout, the body being of a dark colour; and (2) the north or Scotch cod, having a blunter snout, and being of a light ash-gray. The two forms are said to mix off Northumberland. Yarrell, having observed a "lord-fish" (*G. macrocephalus*), Tiles, at the mouth of the Thames, considered the appearance due to disease. Gurney (Zool., May 16th, 1851) remarks upon having seen one of these fish caught at Lowestoft, and called by the local fishermen "a lord," resembling Yarrell's figure. Cobbold found this shortening of the body, which occasions the comparatively large head, to be due to the coalescence of a great number of the vertebræ immediately succeeding the bones of the head. Gill alludes to a Labrador specimen which possessed two barbels below the chin, placed one behind the other. *Of colour.*—Turton's "speckled cod" may have been so coloured due to disease—as the presence of parasites—as some examples are of a light colour, but speckled, especially over the upper half of the body and fins, with small black dots, which under a magnifying glass are seen to be round elevations, some of which have small orifices in their centres. The fins are edged with black. *Codlings* are frequently yellow, or even of a red colour, while living among rocks; they do not assume their adult livery until they change their residence. Edward, at Banff, alludes to occasionally meeting with red codlings, which most frequently had yellow fins; none exceeded the size of the common haddock. In the Isle of Man, where they are known as *Boddagh ruy*, they are not found in very deep water, but generally in rocky localities near the shore. Thompson saw one in Ireland of a pale lilac-gray colour, closely studded over with large reddish-gray spots, which were as close together as in any species of trout. Parnell found the red cod the firmest for eating, and remarked that they resided in very deep water, feeding almost entirely on young lobsters and star-fish.

Habits.—A voracious fish, which, as a rule, feeds near the ground. It is indiscriminate in its choice, consuming whatever inhabitants of the deep it is able to master. The most elaborate investigations into the life history of this fish have been made by Sars off the coast of Norway. Large cod fisheries begin along the north-west coast of Norway, generally in the winter; consequently, the fish would seem to commence arriving all about the same time, and though each school does not follow the identical course of the one preceding it, they may be imagined as coming in numerous parallel lines, and in a north-easterly direction from the great deep towards the shore. The chief fisheries are in the middle of the winter, or first four months of the year, and about the same time as the great spring herring fisheries. It was observed that near Christmas unusual numbers of small fishes appear on the banks off the north-west of Norway, and before long the cod-fish make their appearance; soon the other and smaller forms decrease in number, until at last it appears as if only cod were present. The first comers (species doubtful) are termed the "announcing fish" by the fishermen, as they are the advanced guard of the large army which begins to appear about the middle of January, and continues arriving in schools, consisting of milters and spawners, until the middle of March. In other years they may even commence arriving as late as March, the period varying with the weather, as they come in earlier when it is mild, with a south-westerly wind, than when it is cold, with north-easterly gales. During a good season they are described as forming "mountains of fish," but frequently none can be captured at this period, either with seines or lines; the fishermen say they keep quiet until a new school arrives and drives them forward, their quiescence being probably due to the coldness of the water as compared with that at the depths from which they have left. They are found to keep nearest the bottom in coldest weather, while the fishermen (at least in certain localities where the current is not too strong) use floats to keep their nets or lines some distance from the ground; consequently, such lines as are suspended at both ends only have the central portion reaching the bottom, while the remainder gradually approaches the surface, and thus cod are taken at often twenty or thirty fathoms from the ground. On leaving the coast of Norway they seem either to go direct out to sea, or along the western shores, their course appearing to depend considerably upon the temperature of the water. They consume small fish, as the young of their own kind or any they can obtain, but are especially partial to sand-eels, herrings, sprats, and the spawn of herrings, also crustaceous and testaceous animals, and, as is well known to fishermen, evidently preferring one sort of animal food to another, being very partial to crabs and whelks, while their digestion is so powerful that the greater portion of the shells they swallow are dissolved. They often disgorge their food when hooked and being drawn on board. In the North Sea they frequently feed at night-time on the herrings meshed in the drift-nets, doing much damage to the light cotton nets; while off Devonshire and Cornwall they feast extensively upon pilchards during the autumnal migration. The contents of their stomachs are almost infinite: from one captured in Lynn Deeps on Midsummer-eve, 1626, and brought to the Vice-Chancellor of Cambridge, was taken a book in three treatises; from another, Captain Hill recovered his keys several days after he had dropped them overboard from a North Sea trawler very many miles distant from where they had been lost. An entire partridge was taken from the stomach of one. Johnston observed that a fisherman caught a cod having a hare in its stomach; while another had a white turnip. Mr. Reid, of Wick, saw a black guillemot in perfect feather removed from the stomach of one of these fishes in March, 1879; while Mr. Grove took a piece of tallow candle seven inches long from the inside of a cod. Stones and similar indigestible substances are frequently found in their digestive cavities, and which have probably been swallowed in order to obtain the corallines which were attached to them; it subsequently rejects the stones, &c. Couch observed six picked dog-fishes, each nine inches long, removed from inside another; while he records numerous species of stalk-eyed crustacea taken from examples captured in the portion of the British Channel. A Norway lobster

(*Nephrops Norvegicus*) has been found in one from the Scotch coast. Examining a considerable number of stomachs removed from cod-fishes taken on the east coast of England during the winter of 1880–81, whelks and crabs, especially *Hyas coarctatus*, appeared to have formed their principal food. Sharks, dog-fishes, seals, &c., are found preying on them, and sea-birds and larger fishes on their young. Thompson ('Depths of the Sea') observes upon having dredged over the Faroe Bank at a depth of from 200 to 50 fathoms, the bottom gravel and nullipore, and the temperature from 8° to 10° Centigrade. The banks swarmed with the common brittle star (*Opliathaix fragilis*), with the Norway lobster (*Nephrops Norvegicus*), large spider-crabs, several species of *Galathea*, and many of the genus *Crangon*. So ample a supply of their favourite food readily accounted for the abundance and excellence of the cod and ling on these banks.

They may be kept in salt-water vivaria, as I have already alluded to. Near North Queensferry a number of fish are kept in a salt-water pond about 200 feet long and 5 fathoms deep, in which the tide ebbs and flows twice daily. Here the fish, especially the cod, appear to thrive well, and are found to be firmer in the flesh and thicker across the shoulders than those obtained from the Firth of Forth (Parnell). Yarrell likewise alludes to similarly formed vivaria as existent in the Orkneys and in Fife.

Means of capture.—Along our coasts most of the fishing for cod is carried on by means of long or hand-lines, although a few of the fishes may occasionally be netted, as is extensively done off Norway.* The principal English fishery is off the Dogger Bank, between England and

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* This plan is now being extensively tried off the coasts of the United States, and with great success.

Denmark, and on Cromer Knoll on the Norfolk coa where long-lining is engaged in throughout the winter un about April in the former locality, and February in t latter. Many vessels early in the year proceed to Ne foundland, where the season extends from February u April. Off Wick this fishing, which is largely carried during February, is considered to terminate upon March It would fill up too much space to follow out our c fisheries here, but it may be remarked that some are ta throughout the year around our coasts, and during summer it is not unusual for wanderers to come clos shore, and be captured in the bag-nets set for salmon.

As showing the productiveness of these fisheries, th of Norway closed in May, 1881. The total yield of season's fishery has been estimated as amounting to twe five millions and three-quarters of cod-fish (of which n ber twenty-one and a half millions have been sal 48,000 tons or barrels of liver, 2500 barrels of medicinal t oil, and 31,000 barrels of roe. Outside the island stat the fishing yielded five millions of cod-fish (600,00 which have been salted), 11,700 barrels of liver, 70 to medicinal train oil, and 6000 tons of roe. Of the sm fisheries, which have also closed, the two principal fis stations have produced—the one near Sondmore, 16 vog. (18 kilogrammes each) of cod-fish, 5000 tons of 2200 barrels of medicinal, and 1800 tons of other kin train oil; the other station, near Romsdal, 600,000 fish, 450 barrels of medicinal, and 200 tons of com train oil, and 600 tons of roe. In June it was obs that the Arctic cod-fishing this year has proved a fa Five of the fishing vessels from North Faroe have retu to Shetland with takes ranging from only 2000 to cod. One vessel, the *Walrus*, is reported to have the highest take of the fleet; a second trip will probably be made later in the season.

Bait.—It is very voracious, devouring everything eatable. Mussel are most used in Moray Firth, or the limpet (*Patella*); also "Badgers," a common shell-fish, *Lutraria vulgaris*, and the "spout-fish," *Solen siliqua*, are very killing, but more especially the "sand-launce" and "herring."

The "cod murderer," in use at Peterhead, consists of a long piece of lead, either round or flat, with snoods passed through holes at intervals, bearing a hook at either end, without bait. The cod strikes against the lead, and one or other of the hooks generally secures it ('Angler's Note Book,' p. 48).

Breeding.—The cod arrives from the deep sea, and commences spawning in our seas, usually in January, and continues this operation until about April. In the Firth of Forth, however, Parnell observed that they begin to deposit their spawn in the months of May or June, and it must be remarked that they are much later in cold and boisterous seasons than in calm and mild ones. They are very prolific. Leuwenhoeck counted 9,384,000 eggs in one of medium size; Harmer, 3,686,760 in one taken at the end of December; Buckland, 1,800,000 in a 1½ lb. fish in March, while he found in 7¾ lb. of cod roe 6,867,000, and such a quantity sometimes exists, that from fish of 21 lb. weight 12 lb. of roe have been removed. Off Norway, Sars observed that at the spawning period the cod became restless, the males and females swimming about very rapidly, while spawning was continued some months, during which period the fish get out of condition. The females, as a rule, were nearer to the surface than the males, as proved by netting, for the drag-nets almost exclusively took males, whereas the floating-nets secured females. The ova was found to float on the sea, unless the specific gravity of the latter was altered by the admixture of rain or river water, as well as on the death of the embryo, when they sank. The egg floats, due to containing a fine globule of oil, while its heaviest part is where the micropyle exists, and which is consequently turned downwards or towards the ascending milt. Hatching occurred on the eighteenth day, while in America it was found to take place between the thirteenth and fiftieth days, according to the heat of the water. The floating eggs and fry are liable to be blown in shore, or destroyed by the action of wind and waves. Several millions of the eggs of this fish have been deposited and hatched in the outer harbour of Gloucester, U.S., in the hopes of raising a local supply, for the water there is too warm for them to naturally seek that locality.

Life History.—The young fish, according to Sar's investigations, at first, or before the umbilical bag has become absorbed, are most helpless beings, floating on the surface, and tossed about by winds and waves. As soon as this sac is absorbed they seek deeper water, where the sea is more quiescent, feeding upon small transparent crustaceans, as "herring food," *Calamus finmarchicus* and *Temora longicornis.* By the end of the summer, and when about an inch in length, they go more inshore, first finding shelter each under a medusa, *Cyanea capillata*, where they appear to feed upon the minute animals which constitute the food of this Discophora, and which are stupefied by its numerous poisonous threads, stretching out in all directions. As a return, the young cod-fish consumes a small parasitic crustacean, *Hyperia*, which clings to the medusa by aid of its sharp claws, and even eats deeply into its jelly-like body.

These young fish have also been observed floating about beneath the harmless disc-shaped *Medusa aurita*, or secreting themselves beneath sea-weeds or other floating substances. Having left the medusæ, they roam about for some time, but being pursued by sea-birds and other fishes, they seek a more stationary mode of life near the coast, where, however, young pollack have generally previously established themselves. As they grow in size, they migrate into deeper waters, and at the age of one year they are known as Algæ fish by the fishermen, because they resort to sandy localities among the algæ near the outer coast, at a depth of twenty or thirty fathoms. These very young are of all different shades of colour, from bright red or yellow, if residing among the *Laminaria*, to a bright green or gray if in more open or sandy places. The very young cod-fish are genuine ground-feeders. Respecting the rapidity with which these fish increase in size, opinions are divided, but at the Southport Aquarium, some of ¾ lb. in weight increased, in about sixteen months, to 6 or 7 lb. each (Jackson).

Hermaphrodites have been recorded by Yarrell (Proc. Zool. Soc. 1845, p. 91) and Dr. J. Smith (Proc. Roy. Phy. Soc. Edin. 1864-65, p. 300, and vol. iv., 1870, p. 256).

Diseases.—I have already alluded to affections of the spinal column, blindness, and parasites in the cod. When out of season they are tormented with sea-lice, while the *Lernea branchialis* is usually found attached to the gills. When hooked, the borer or myxine, having obtained entrance through its mouth or gill openings, will almost devour its interior, leaving little but the skin remaining. Off the Shetland sandbanks a sessile-eyed crustacean, locally termed "bees," *Æga tridens*, has been observed to behave in the same manner among fish hooked on the long-lines, so that when the fish is hauled up it looks as plump and round as a live fish, only when opened it is found to be full of "bees," and nothing else (J. Anderson). I may here mention, as one of the causes of prevention of the due increase of these fishes, that large quantities of the roe is collected and sold, being employed in France and Northern Spain as bait for the sardine fisheries.

Uses.—From the air-bladder or sounds isinglass may be manufactured. The tongue, whether fresh or salted, is a great delicacy, while from its liver is prepared an oil, first employed as medicine in this country by Dr. Percival, in 1782. Irrespective of the foregoing, we are told that the Norwegians give the head, along with marine plants, to their cows, for the purpose of increasing the yield of milk. Icelanders feed their cattle with its bones, as the inhabitants of Kamtchatka do their dogs, while, after being well dried, they are employed as fuel along the shores of the Arctic Ocean.

As food.—The cod of our seas is in the best season from October to the beginning of February, in the Firth of Forth till the end of April, and in its greatest perfection about Christmas, while those of a medium size are most preferred for the table. It has been observed that such as possess the deepest groove along the back of the head, the largest belly, roundest form, especially near the tail and sides, and appearing as if they were ribbed, are the most superior for the table. In Cornwall those out of season, and recognisable by their lanky form, are sure to be woolly and watery; they are locally known as "Churchyard Cod," and may be seen exposed for sale as early as the month of March. In Norfolk it was formerly considered that the finest supplied to the market were those sent from Sherringham, which were usually found to have been feeding on crabs. "Lhen Cod," in the Isle of Man, is a local variety much prized by epicures, supposed to come from a superior feeding locality near the point of Ayre.

Modes of cooking.—Rutty observed that in his time (1772) the Fitzgallian fishermen made a broth at sea from the cod and haddock, which they thickened with the liver of the cod, bruised to a paste, and incorporated with the broth. When fresh, the head and shoulders are boiled and served with oyster sauce and melted butter; or the body may be similarly treated, or it may be stewed. Slices of the fish may be fried, and are improved by some curried gravy being added. Salt fish may likewise be boiled; also salted cod's sound, while the last are sometimes fried in butter.

Cod can be preserved in salt, and remain good for eating a much longer period than any other form of the family. For curing, as observed by Bertram, the fish should be used as soon as possible after capture; they are split along their entire length, and well washed until all the blood is removed. A part of the backbone having been cut away, they are drained, and then laid in long vats covered with salt, and weighted down, in order to keep them well under the pickle. After a time they are removed, drained, washed, and brushed, to prevent the collection of impurities. Then they are bleached, by being individually spread out in the open air. This accomplished, they are collected into heaps, termed *steeples.* When the *bloom*, or whitish appearance, shows itself, the process is complete, and they are ready for market. In the trade the salted cod-fish, brought from Norway and elsewhere, are roughly divided into *flat* or *klip*, and *rund* or *stock-fish*, the first form being salted and subsequently dried, and the second simply dried without the use of salt.

Habitat.—In the northern seas of Europe and America, from about the 67° to the 50° of latitudes, for such as are found north or south of these limits are either few in quantity or inferior in quality, except perhaps along the coast of Norway, where, due to the presence of a warm gulf stream, it may be taken a little further to the north, while those present in Greenland are small, emaciated, and voracious. It extends principally from the south and west coasts of Iceland and the shores of the Scandinavian Peninsula, through the North Sea and coasts of the British Isles to those of France; while it is most abundant off Newfoundland, where a mud-bank, more than 100 leagues long, and 60 broad, exists, buried in the ocean at from 60 to 100 feet or more below the surface.

In the Orkneys it is said to swarm around the coast, but Low remarked that in his time the fishery had become abandoned, and they were little sought after; they are very abundant in Zetland, and are taken all round our coasts, but in decreasing numbers as we proceed southwards. It is abundant in the sea around the islands to the north and west of Scotland; has been locally remarked upon as present at Wick; along the coast of Banff; Aberdeen. In the Moray Firth in all seasons, but most plentiful in March. St. Andrews, common. Firth of Forth, all the year round. Yorkshire, abundant; codlings are taken plentifully inshore, and ascend the estuary of the Humber as far as Goole. From Lincolnshire and Norfolk to the mouth of the Thames; Devonshire coast not so common or good as those from the north or north-east coast. In Cornwall, common all round on sandy banks, and rough ground in sheltered bays, but rarely in good condition for the table. In Ireland common around the coast.

The largest Pennant heard of from our coasts weighed

78 lb., it was 5 feet 8 inches long, and captured at Scarborough in 1755, and sold for one shilling; their usual weight in Yorkshire he gave at from 14 to 40 lb. Thompson records two taken on the same day in Belfast Bay, which weighed 56 and 60 lb. respectively. Yarrell, one of 60 lb., taken in the Bristol Channel, and produced five shillings.

2. The Haddock (*Gadus æglefinus*).

Names.—*Haddock,* formerly spelt *hadock,* which in Scotland is pronounced *hathock* or *haddie,* and which after spawning are termed *gamrels* or *camrels*; when about five inches long, *nockies* (Sim, Aberdeen). This fish has likewise other local names as *buckthorn,* which is mostly applied to dried haddock; *mop,* and *whiting mop,* also *mulvel* (Halliwell). In the Moray Firth it is termed *adag* or *attic* (Gordon); in the Firth of Forth they are *finnan haddocks,* when smoked in a peculiar manner; if simply dried *speldrings,* and are eaten raw (Parnell). Belonius states that *Egrefin* or *Eagle-fin* was formerly its English name.

B. vii., D. 14–16 | 20–24 | 19–21, V. 6, A. 24–25 | 20–22, Vert. $\frac{19}{34}$.

Length of head $4\frac{1}{4}$ to $4\frac{1}{2}$; height of body $4\frac{1}{4}$ to even 6 in the total length. *Eye.*—Diameters $3\frac{1}{2}$ to 4 in the length of the head, $1\frac{1}{2}$ diameters from the end of the snout, and $\frac{2}{3}$ of a diameter apart. Snout somewhat projecting over the mouth; the upper jaw rather longer than the lower; the posterior extremity of the maxilla reaches to nearly or quite beneath the anterior edge of the eye. A short barbel situated beneath the chin. *Teeth.* — Cardiform in the jaws, the outer row in the upper jaw somewhat enlarged. *Fins.*—The first dorsal, somewhat triangular in shape, commences over the base of the pectoral; a short but distinct interspace between the first and second dorsal fins; the third dorsal fin is not continuous at its base with the second, and not connected with the caudal. The first anal fin commences below or slightly behind the origin of the second dorsal. Ventral inserted on a line anterior to the base of the pectoral. Vent situated beneath the origin of the second dorsal fin, or in some few instances a little in advance of this spot. *Colours.*—Grayish in the upper half of the body, light on the sides, and white beneath. A large oval black blotch exists on the side between the pectoral fin and lateral-line, being sometimes continued above it. Lateral-line of a deep black. Fins, bluish-black, being darkest externally.

Superstition has handed down the tradition that the black blotch on either shoulder of this fish is consequent upon the action of St. Peter's finger and thumb when he drew out one of the haddock's ancestors from the Lake of Genneserat to obtain from its mouth the piece of tribute-money. Unfortunately, neither this fish nor the John Doree, which has been equally honoured, are to be found in the waters where the miracle occurred.

Varieties in form.—Shortened forms occasionally exist, due to disease of the vertebral column. In *colour*, several varieties have been recorded. Thompson saw one about 18 inches long, from Belfast market, of a beautiful rich salmon colour in its upper half, becoming lighter on the sides and abdomen; this tint was also observable on all the fins with the exception of the extremity of the caudal, which was dusky. The finger spot was faint. Another example, captured off the entrance to Strangford Lough, was of a pale golden yellow superiorly, and white below the lateral-line, which, instead of being black, was white; no finger spot was visible. Dr. Ball obtained a large canary-coloured example in Dublin, and another small specimen of a light rose red. In the month of February, at Belfast, Thompson's attention was called to a large haddock in fine condition, which was clouded over the sides with an extremely pale stone colour, apparently as if the skin had been taken off; but this was the natural colour, as all the scales were on.

Habits.—Haddocks congregate in enormous numbers, feed near the ground, and for their size are as voracious as the cod, but the two forms do not seem to be usually found together. They are abundant off our shores, especially along those of the eastern counties, the finest and greatest numbers being taken during the winter months, for after spawning the largest retire, leaving the smaller ones behind. Pennant observed that off Yorkshire large schools usually arrive near the shores in December, and instances the coincidence that in 1766 and 1777 they came both years on the 10th, the shoals being nearly three miles in breadth, while they extended in length from Flamborough to Tynemouth Castle, and perhaps much further to the north. They will frequent some rocky ground for many seasons, and from some cause suddenly leave it for a new situation, perhaps due to exhaustion of the food. "Fishermen assert that in rough weather haddocks sink down into the sand and ooze at the bottom of the sea, and shelter themselves there till the storm is over; because in stormy weather they take none, and those that are taken immediately after a storm are covered with mud on their backs" (Pen.). Their food varies with locality. Thompson in Belfast observed they mostly contained the remains of *ophiuræ*, especially the spines of *O. rosulo*, the presence of which is considered by Dr. Drummond as one reason why these fishes are found so free from intestinal worms. During summer they live on young herrings and other small fish: in the winter on the stone-coated worms (serpulæ), which fishermen call haddock meat. They consume great quantities of herring ova and fry, while the sprat is likewise favourite food.

In the Phil. Trans. Royal Soc. 1792, pp. 367–373, is an account of a remarkable failure of these fishes in Northumberland.

Means of capture.—Line or beam-trawl fishing, as it generally feeds near the ground. Off Norfolk long lines for haddock fishing, the length of each of which is about 370 fathoms, are locally termed schulls. In the Moray Firth it is taken throughout the year, except during the six or eight weeks of the herring fishery, when the fishermen are otherwise engaged; but in stormy weather it refuses all baits. Pennant (1776) observed that three fishermen within one mile of Scarborough Harbour frequently loaded their coble or boat with them twice a day, taking each time about a ton of fish; when they shot their lines upwards of three miles from the shore they took nothing but dog-fishes, which showed the limits to which they resorted for feeding. The best sold at 1*s.* to 1*s.* 6*d.* the score, and the smaller ones at a penny and sometimes a halfpenny a score.

Baits.—Cuttle, mussels of both the horse and edible species, sprats, and cod bait.

Breeding.—In America, a haddock of 2¼ lb. gave 169,050 eggs, the number increasing in quantity until from one 9⅞ lb. 1,839,581 were taken; the shortest time required for hatching was eight, and the average nine days. Pennant observed that they spawn in January. Some are certainly in full roe during February and March, during which latter month R. Couch observed that they spawned in Cornwall; nd, Parnell, that they likewise did so in the Firth of Forth.

marked that the spawning process of this fish is very similar to that of the cod, and in the Loffoden Islands takes place about the same time. Off Cape Ann in America the number of males are observed to be more abundant than the females, but the latter averaged a larger size.

Life History.—Sars found the young in the sea off Loffoden Islands concealing themselves under medusæ similarly to the cod.

Uses.—Haddocks taken by lines are far superior, their flesh being much firmer, than those captured by the beam-trawl, in which they are bruised, and generally have their scales rubbed off. But the trawl-haddocks are by no means wasted as food, the head being cut off and with the intestines used for manure. They are then split and smoked and sold as smoked haddocks. Haddocks will not take salt so well as cod. In the neighbourhood of Walworth and Kennington there are several curing houses. The fish are bought by the costermongers in Billingsgate market in the morning, pickled, skewered, hung up in the smoke of sawdust by the evening, and when sufficiently tinged a yellow colour they are fit for sale. A skilled curer can clean, salt, and smoke a load of haddock in from six to eight hours. Those from Finnan, near Aberdeen, have obtained a great reputation. All at first were smoked over a peat-reek, but the demand becoming very great they were cured in special buildings erected for the purpose, and smoked in large numbers over burning fir branches or burning sawdust.

As food.—The small ones, not sufficiently old to breed, are extremely good from May until February, and some few even so late as April; but the flesh of the larger ones is often dry and hard; still, up to 2 or 3 lbs. in weight it is a good table fish for midwinter. It is in the best season from November until February, while in the Irish markets the larger the haddock the more it is generally prized.

[illegible]

[illegible]

[illegible] subsequent years [illegible] Mr. Hine [illegible] some years [illegible] Dagenham Reach in Essex, and [illegible] was standing [illegible] appeared to be floating at the edge of the [illegible] saw a large haddock of [illegible] eyes, which the [illegible] other haddocks [illegible] quite dead and others nearly [illegible] the keeper he stated that those [illegible] the Thames into that brackish water [illegible] at that time of the year and that after they had [illegible] they were so weak and feeble that they lay on the surface and the wind gradually wafted them to the shore. The rooks took advantage of this, and attacked them.

Habitat. From the Arctic portion of Europe, having a range very similar to the cod. In February and March it appears to be most abundant off the shores of Northern Europe, while in the autumn it is usually plentiful off Holland, East Friesland and Heligoland. It is found in varying numbers round the British Isles, and along the Atlantic shores of France. In the western hemisphere it extends from Newfoundland to Cape Hatteras. Although the haddock is common in Orkney and Zetland it is not so numerous as the cod, nor are they caught in any quantities; their visit would seem to be short. Taken at Wick, in Banffshire, extensively cured, and they are more numerous along the eastern coasts of Scotland and England (especially from the Tyne to Yarmouth) than along their western; common along the south coast of England.

In Ireland it is generally common around the coast, but varies in different localities. Dublin Bay is famous for its haddock, while those of Belfast are highly esteemed. At Portrush, co. Antrim, Ogilby observes that on November 7th a haddock was captured, a great prize, as none had been obtained for the previous ten years, the fish having quite deserted the ground where they were formerly very numerous. However, on opening it it was found to be diseased and black.

Respecting the size to which this fish attains, one weighing 10¾ lb. was landed in February, 1878, at Wick; another was taken in Dublin Bay which weighed 24¼ lb., and was 37 inches in length. The largest haddock mentioned by Yarrell was 16 lb., from Dublin Bay; by Couch, 25 lb.; and Thompson one of the same size from Groomsport.

3. The Bib (*Gadus luscus*).

Names.—Bib, pout, whiting-pout, blens or *blinds* in Cornwall; these last names are doubtless due to a sort of loose bag capable of inflation existing in front of the eye, and formed by an outer layer of fine and transparent skin passing from the cheeks over the eye, and a second layer over the eye-ball, thus forming a sac-like cavity, well designated by the local words *bleb* or *blain*, terms for a bubble in the water, or a blister. After death this loose membrane, which fishermen assert it can blow up at pleasure, becomes opaque. For the same cause it is perhaps termed *lug*, or "a leaf," at Penzance and St. Ives; *bothock*, or "large eyes." Said to be known as *kleg* at Scarborough; *siller-fish* and *jackie-downies*, Moray Firth; *smeltie*, Zetland; also *brassie* in Scotland; *deillion* at Carnarvon, also *bragay* and *stink-alive*.

B. vii., D. 12 | 20–23 | 19–20, V. 6, A. 27–32 | 17–20, Vert. 48.

Length of head 4½ to 4⅔; height of body 3½ to 4 in the total length. *Eye.*—Diameter 3 to 3½ in the length of the head, 1 diameter from the end of the snout, and 1 to 1½ diameters apart. Snout obtuse, scarcely overhanging the jaw, the upper of which is slightly the longer. The posterior extremity of the maxilla reaches to beneath the middle of the eye. A barbel as long as the eye is present below the chin. *Teeth.*—Cardiform in the jaws with an outer enlarged row in the upper. *Fins.*—First dorsal arises over the base of the pectoral; its second or third ray longest, and no interspace between its last rays and the second dorsal fin, which is connected at its base with the third dorsal, but does not extend to the base of the caudal fin. The first anal fin commences beneath the middle or posterior third of the first dorsal; the second anal fin similar to the third dorsal. The ventral is inserted some little distance anterior to the base of the pectoral. Vent situated beneath the anterior portion of the first dorsal fin. *Lateral-line.*—Curves very gently to below the last half of the second dorsal, from whence it proceeds straight to the centre of the base of the caudal fin. *Colours.*—Of a beautiful bronze during life, with five or six broad vertical bands rather darker colour descending from the back to the lower surface, meeting those from the opposite side. A black spot at the base of the pectoral fin. Fins bluish-black, darkest at their outer edges.

Habits.—It adheres pertinaciously to one locality, especially the vicinity of precipitous rocks, as off the coast of Cornwall. Here it seeks a secluded crevice or gully, where it conceals itself during the daytime, sometimes thousands seeking the same spot. It usually feeds at night-time, extending its excursions over the high grounds and on to the low rocks and sands in the vicinity. Assemblages of these fish are known as "chains of bibs," two or more of which may be found so close together as to be merely divided by a ledge of rock of a few feet in width; one chain of bibs may be light coloured, and the contiguous one banded with dark. In cold and stormy winters it retires to the deep sea, returning again in spring. The knowledge of the exact localities where these fish reside has been kept in some fishermen's families for generations. It thrives pretty well in an aquarium, but after a time becomes of a lighter colour. Thompson mentions finding small crabs (*Brachyuri*) and a *Trochus tumidus* in the stomach of one which he opened, while another contained fish remains; it also eats worms.

Means of capture.—Line-fishing; they are very voracious, and the exact spot they reside in has to be chosen, and the line must be near the bottom, while on it three or four hooks may be used.

Breeding.—Spawns towards the end of the winter in Cornwall.

As food.—Good eating when 2 lbs. in weight and upwards, but its numerous bones deteriorate from its use. It rapidly decomposes after death, which likewise detracts from its value.

Habitat.—From Scandinavia along the Atlantic coasts of Great Britain and Europe, but is only a wanderer into the Mediterranean. Occurs in Zetland; Banffshire, common, but is mostly used for bait; not uncommon at St. Andrews, and found in Berwickshire; also reported as not uncommon in Yorkshire; occurs off Norfolk, the Sussex coast, and becomes very common along the Devonshire coast, and numerous in Cornwall, especially during the autumn and winter. Yarrell alludes to its presence in Carnarvonshire, as well as in Loch Foyle.

In Ireland, according to Thompson, it is of occasional occurrence on all quarters of the coast; and examples occur at all seasons of the year in the Belfast market, where he observes the females are termed ***hen-fish***, and *crow-fish* in Galway Bay.

It seldom exceeds a foot in length, but Yarrell mentions having seen one 16 inches.

b. *No barbel below chin.*

4. Whiting (*Gadus merlangus*).

Names.— *Whiting*, pronounced *fittin*, in Scotland. ***Cuideag***, pronounced *cuitschach*, in the Moray Firth. ***Whiting-mop***, "a young whiting." At Aberdeen, those found in June and July are termed *dargs*, *Power*, or *poor-cod*.

B. vii., D.13-16 | 18-23 | 19-21, V. 6, A. 30-35 | 20-24, Vert. $\frac{23}{31}$.

Length of head 4 to 4¼; height of body 5¼ to 6 in the total length. *Eye.*—Diameters 4 to 4½ in the length of the head; 1¼ diameters from the end of the snout, and ¾ to 1 diameter apart. Snout conical, slightly projecting over the upper jaw, which latter is a little longer than the : the maxilla reaches posteriorly to beneath the middle of the eye. No barbel beneath the chin. *Teeth.*—Cardiform, with some larger ones intermixed in the lower jaw, the outer row enlarged in the upper jaw, in a semilunar patch upon the vomer; none on the palatines or tongue. *Fins.*—First dorsal commences opposite the first third of the pectoral; its second and third rays the longest, the last ray very short. A short interspace between the bases of the first and second dorsal fins, also between the second and third dorsal fins, which latter does not quite reach the base of the caudal. First anal fin commences beneath the middle of the first dorsal fin, and terminates beneath the end of the second dorsal; the second anal and third dorsal fins similar. Ventrals some little distance before the base of the pectoral. *Lateral-line.*—Commences opposite the upper edge of the opercle, and curves gently downwards; from opposite the anterior half of the second dorsal it goes direct to the centre of the base of the caudal. The vent is situated beneath the middle of the first dorsal fin. *Colours.*—Back, greenish gray or yellowish, becoming silvery on the sides and beneath; in the fresh state several yellow lines pass along the sides. A bluish-black blotch exists in the axil of the pectoral fin. Vertical fins dark in their outer two-thirds.

Varieties—in colour.—The axillary spot is occasionally little marked, or even entirely absent.

Habits.—It appears in the spring in large shoals, delighting in sandy bays where young fish abound; it seems to be shy, and mostly keeps from half a mile to three miles from the shore, in spring-time hanging about the more distant rocks. In Cornwall it swarms into the bays in autumn to feed on young pilchards. It appears to be very susceptible to the influence of cold. In the Moray Firth it is said to be most abundant in May and June, but in the best condition during November and December. It is a voracious feeder, subsisting on small fish, crustacea, and any animal substances it can obtain. Yarrell took several sprats from inside one, and Couch some pilchards.

Means of capture.—Whiffing, when they give good sport, especially during rough weather; they are likewise taken by the trawl. They bite best early in the morning or in the evening. They will rise by moonlight into mid-water after their prey.

Baits.—Common mussels, or slice of the herring or cuttle, but they generally prefer living prey.

Breeding.—It spawns in March not far from the shore.

As food.—They are much esteemed, being very easy of digestion. They are in the best condition from November, not being so deleteriously affected by breeding as the other gadoids, therefore eaten throughout the year; but, being somewhat out of condition during April, May and June, invalids should avoid them, as they are apt to occasion nausea and even vomiting. They have to be disembowelled prior to being transmitted to inland markets, or they rapidly decompose, and are best when eaten immediately after being captured. A considerable portion of these fish are salted or dried when the takes are in excess of the demand. Small ones salted and dried are termed *buckorn* from Dartmouth to Cornwall.

Habitat.—Off Scandinavia and in the northern seas, the German Ocean, and along the Atlantic coasts of Europe to the Mediterranean.

It is distributed around the British shores, but the largest quantities are obtained off the south coast, especially in the vicinity of Plymouth, while very fine ones from 2 lbs. to 3 lbs. each are got from Dartmouth. In the Orkneys, Low observed upon having seen this species caught once or twice, but he concluded that it could scarcely bear the rough gusts of the winter seas, being a delicate fish. When haddock are caught in any quantities, whiting are taken in numbers. Orkney and Zetland not common; at Banff often captured, but not so good as the haddock; frequent at St. Andrew's; Firth of Forth, plentiful; resident and very abundant off Yorkshire; plentiful in the Norfolk estuary, especially in the autumn, but those on the Norfolk coast only attain to about two-thirds the size of those off Devonshire; common along the south coast of England, and very abundant off Devonshire and Cornwall, especially in the latter county, from September until March, the largest and best coming from Polperro.

In Ireland it is common around the coast, but not held in much estimation in the north. It is considered in its finest season in the spring.

This fish has been recorded off the British coasts up to 16 inches in length, and from 3 to 4 lbs. in weight, but Couch mentions his having heard of one weighing 7 lbs., while Pennant records a fish from 4 lbs. to 8 lbs. weight, taken from the edge of the Dogger Bank.

Lower jaw the longer; teeth in upper jaw of equal size.

b. *A barbel below chin.*

5. Coal-fish (*Gadus virens*).

Names.—Coal-fish, so termed from its occasional black colour, it being called *cole-fish* by Ray, *col* signifying charcoal, not due to its producing isinglass or *ichthyocolla*, as believed by Belonius, from its English name of *colfisch*. Another derivation of the term *cole-fish* has been found in the corruption of the French name "colin." *Sillocks*, Scotland, and *blue-backs*, Yorkshire; *rauning* (ravenous) *pollack*, Cornwall; also locally as *baddock*, *bil*, *billet*, *billard*, *black pollack*, *black-jack*, *bleck*, *coalsay*, *coalsey*, *coal-whiting*, *colemie*, *colmey*, *cooth*, *cudden*, *cuddy*, *dargie*, *gilpin*, *glassock*, *glashan*, *glossan*, *glossin*, *green-cod*, *green-pollack*, *gray-lord*, *gull-fish*, *harbine*, *kuth*, *lob*, *lob-keeling*, *moulrush*, *piltock*, *podlie*, *podling*, *prinkle*, *rock-salmon*, *saithe*, *sethe*, *sey-pollack*, *sillock*, *skrae-fish*, *stenloch*, *tibrie*. The fry are called *parrs* at Scarborough as well as in Northumberland, and *soil*, *poodler*, *billets* or *billiards* up to one year of age; *cuddies*, *saithes*, *coalman*, also *saidhean*, or *suyeen* (Moray Firth); and *gerrocks* at Banff; *herring-hake* at Aberdeen.

In *Ireland* its names are legion. In county Down it possesses four: the fry are *gilpins*, next size *blockan*, then *gray-lord*, while the adults are termed *glashan*. The young in some localities are also called *cudden* or *pickey*. In some parts of the south and west these fish are termed *black-pollack* or *glassin*. At Roundstone the young are called *glossan* and *moubrush*, while adults are termed *coal-fish*; at Portrush the fry are about early in the spring, and by the time they are from 4 to 7 inches in length they are known as *cadan* (pronounced *cudden*); next spring they are termed *ceithnach* (pronounced *catenach*), perhaps an expansion of the last name, since the termination *ach* signifies "like." In the following autumn, when weighing about 2 lbs., they are known as *glasan* (pronounced *glashin*), in allusion to their green colour, and a year later *two-year-old glasan*. Subsequently they are entitled to the full term *gray-lord*, as when they are from 8 lbs. to 25 lbs. weight.

B. vii., D. 12–14 | 19–22 | 20–22, V. 6, A. 24–27 | 20–23, Vert. 34.

Length of head 4¼ to 4¾; height of body 4¼ to 4¾ in the total length. *Eye.*—Diameters 3⅓ in the length of the head, 1 diameter from the end of the snout, and $\frac{2}{3}$ to 1 diameter apart. Lower jaw prominent. The maxilla reaches to below the first third of the eye. A rudimentary barbel beneath the chin. *Teeth.*—Cardiform in the jaws, present on the vomer, absent from the palatines and tongue. *Fins.*—The first dorsal triangular; a distinct interspace between it and the second dorsal fin; an interspace between the second and third dorsal fins, the latter not extending on to the caudal. Anal commences below the last rays of the first dorsal, and terminates below the end of the second dorsal; second anal similar to the second dorsal. Ventral inserted anterior to the base of the pectoral. Vent situated on a vertical line beneath the last rays of the first dorsal fin. *Colours.*—Superiorly gray, becoming silvery on the sides and beneath. Fins gray, the dorsal and caudal dark-edged. Usually a black spot at the axis of the pectoral fins, by which it is mostly concealed. As they get older the dark colour deepens. Lateral-line white, which at once distinguishes it from the haddock, wherein it is black.

Varieties.—Thompson mentions obtaining a specimen 7 inches long, in May, 1836, at Ballywalter, which seemed intermediate between the *G. pollachius* and *G. virens*, both of which he obtained at the same time and place. Couch remarks on one which had the upper jaw shortened and the body depressed out of the regular straight shape. The vent was much behind its usual position. The fish was thin and ill-fed.

Habits.—Generally gregarious, especially when pursuing herring, to which form of food they appear very partial. In the Orkneys the fry are first seen in May, when they are taken in large numbers by angling; but it is in the winter, when the sea begins to get stormy, that the large shoals appear. At this period they are from 6 to 10 inches in length, and much esteemed as *sillucks;* about March they retire to the deep and grow rapidly, so that by May they are 15 inches long and termed *kuths*, which are tolerable for eating either fresh or roasted with the liver, or even dry. A few are taken in the second year, when they are called *two-year-old kuths* or *harbines*, and are now very coarse and not sought after. Subsequently they attain to a vast bulk, and are then termed *seths*, but are rare (Low). Dr. Drummond gives an account of once finding his boat in the midst of a shoal of these fishes when at play. The whole sea was alive, while they were disporting themselves in all attitudes. They were regardless of the boat, and so intent on their gambols that numbers were captured with an instrument like a boat-hook. Mr. Dunn has remarked the same phenomenon, but he ascertained that it was due to their chasing small fishes. During the smooth season of the year the coal-fish approaches the shore and moves quietly about, but when it descries any prey it pounces on its victim with great violence. Thompson mentions finding principally small crustaceans, as *Idotea*, &c., in the stomachs of these fish; Dr. Drummond usually observed that they were gorged with *Onisci*, and very fond of *Entomostraca*. Mr. Ffennell saw twenty-six salmon fry taken from the stomach of one of these fishes.

Means of capture.—Angling, which is often done from shore, and line-fishing, the lug-worm being found a good bait. They are very voracious, and have great strength. In Belfast Bay a few large examples are occasionally taken in the mullet nets during the spring of the year.

Breeding.—A coal-fish 39½ inches long had 4,029,200 eggs, and one 7 inches shorter 2,569,753, and they seem to spawn while swimming about, when their eggs, being buoyant, are found on the surface. They would appear to hatch in four or five days in water of moderate temperature. In Cornwall they spawn in the spring; in the Orkneys small fry are seen in June (and in July, off Yorkshire) in vast shoals, wherein each fish is about 1½ inches in length; by August they have attained to from 3 to 5 inches, when they are angled for.

Uses.—Low remarked "as things are at present with us, this species is the treasure of the Orkneys; while these are to be found, none else are regarded." In *Land and Water* a correspondent observed that an oil is prepared from their livers, but towards winter in the Shetlands they are swept ashore in enormous quantities, and are often purchased for manure. They now fall off very much in condition, and are bought in order to obtain oil, which is used for lamps. In June or July those 9 or 10 inches long are in the perfection for eating, if cooked within an hour or so of being caught. The oil is in good demand by tanners.

As food.—Unless when small it is little esteemed when fresh, but salts well; its flesh is coarser than that of the pollack. Fishermen in Cornwall salt it for home consumption.

Habitat.—It is taken off the coasts of Scandinavia, and abounds in the North Sea and northern coasts of Europe, and extends around Great Britain to the shores of France, and into the Mediterranean. This fish has also been reported as existing in Nova Scotia (Gilpin).

It is common off most of our deep and rocky coasts, especially in the north; and in the Orkneys and Zetland is extremely abundant; in Banffshire, where it is numerous, more especially the young, it is termed *gerrocks;* abundant at St. Andrews; also in the Moray Firth during the time the herrings are present. A few are taken near Newcastle-on-Tyne, but it is not much sought after, being held in little esteem ; in Yorkshire it is resident and very abundant. In the Norfolk estuary a large one was captured in 1845, and is now in the Wisbeach Museum ; it is frequently taken in Blakeney Harbour. In Devonshire abundant in the bays and sometimes in the harbours. In Cornwall it is common during the winter and spring, when it appears to be gregarious, and resides in strong currents, sheltering itself by keeping behind large rocks, from which it darts out on passing prey.

In Ireland it is one of the commonest fish around the coast, although rare in Dublin Bay. Buckland records one 43 inches long, and 25 lbs., captured in December, 1866 ; and Thompson an example of 32 lbs. weight, which was taken in Belfast Bay.

b. *No barbel below chin.*

Pollack (*Gadus pollachius*).

Names.—Pollack, whiting-pollack, leets (Scarborough), *laits* (Whitby), and in Scotland and some parts of the north of England *lythe*, perhaps signifying its pliancy and rapidity of movement, *laithe, leeat, leet, skeet.* Sometimes termed *greenling* or *green-fish.* Also termed *lythe* at Portrush, county of Antrim. The *lob* alluded to in the Statute of Herrings (31st Ed. III., A.D. 1537) as lob, ling, and cod, evidently meant this fish, not the *Gadus virens* as suggested by Couch. The term is from the Danish word *lubbe*, which signifies the pollack.

B. vii., D. 11–13 | 16–20 | 15–19, V. 6, A. 24–31 | 16–21.

Length of head 3¾ to 4¼ ; height of body 4¼ to 5 in the total length. *Eye.*—Diameters, 4 to 5 in the length of the head, 1¼ diameters from the end of the snout, and 1¼ apart.

Lower jaw prominent, the maxilla extending posteriorly to beneath the anterior edge of the orbit. Barbel absent. *Teeth.*—Villiform, and of equal size in the jaws; in two small patches on the vomer, none on the palatines. *Fins.*—The first dorsal commences over the middle of the pectoral, a short interspace between it and the base of the second dorsal, and a similar interspace present between the bases of the second and third dorsal fins. The first anal fin commences under the posterior rays of the first dorsal, and terminates beneath the end of the second dorsal; second anal similar to the third dorsal. Ventral inserted a short distance before the pectoral. *Lateral-line.*—Curves to beneath the commencement of the second dorsal fin, from whence it proceeds straight to the centre of the base of the caudal fin. Vent beneath the anterior half of the first dorsal. *Colours.*—The back of the fish when captured is of a dark rifle green superiorly, becoming lighter on the sides, where it usually has some golden stripes or spots, and nearly white beneath. Fins dark green, the first dorsal with three oblique bronze-coloured bands, and two longitudinal ones on the second and third, all the fins edged with dark colours, sometimes even black.

Varieties.—Ball observed an example, taken in the spring of 1838, in which the rays of the first dorsal fin had grown to more than three times their normal length. Couch remarks on the young occasionally having its sides and abdomen yellow or bright orange, due, it is believed, to their residing in the shelter of rocks which are covered with ore-weed.

Habits.—This species is common on many of our rocky coasts all round the country, and usually prefers not being far from land, waiting to dash upon any unwary prey that comes within reach. Low observed that in the Orkneys it is frequently close in shore among the sea-ware and in deep holes among the rocks. Mr. Dunn has remarked that off Cornwall it frequently sticks to one spot, from which it extends its range, but is not so sure of returning as is the bib, being a strong fish of a more roving disposition. Mr. Peach observed a small whiting which had taken refuge within the hollow of a medusa, *Cyanea aurita*, but was seen by a young pollack about 5 inches in length, which at once gave chase. The whiting dodged round its friendly medusa, but a second pollack joined the pursuit. An unlucky movement drove the pursued one from its shelter, and an exciting chase immediately commenced. Some more pollacks joined in, and, like a pack of hounds, ran their victim down, which they killed for sport, as they did not attempt to feed upon it. So eager were the pursuers that when stones were thrown at them they showed no alarm, although at other times a single stone would instil terror.

Sars observed off the coast of Norway that the pollack systematically chased the young codfish. Schools of the former appeared to surround the little codfishes on all sides, making the circle narrower and narrower, till all the codfish were gathered into one lump, which they then, by a quick movement, chased up to the surface of the water. They were now attacked on two sides, below by the pollack, above by the sea-gulls. The pollack were also observed to treat sand-eels in the same manner, surrounding a school of them, and forcing them towards the surface of the water, where gulls assisted in their destruction. This fish is likewise partial to herrings.

Means of capture.—It sometimes bites keenly, gorging the bait at once, and also takes a fly, but this sport is best pursued from sunset for about two hours, especially if a fresh breeze is blowing, and then it rises freely at a gaudy artificial fly, roughly made of red and white feathers, but is more choice in its selection of food than is the coal-fish. The boat should be rowed along very gently at about four or five hundred yards from the shore, or in a suitable locality, and the fly be allowed to float from twenty to thirty yards from the stern of the boat. Although the young flood or slack water is generally best for this fishing in some places, the best sport is to be had at high water. Off Plymouth it has been observed that, as a rule, falling water gives the best sport in the open sea, but at the points of bays special configurations of the shore and outlying rocks may alter this general rule. Pollack of small or moderate size will also come close in shore where ridges of rock jut out under a few fathoms of water. A little rain is often conducive to the success of this fishing. At different places and likewise different fishermen will praise various sorts of bait for whiffing, but live sand-eels would appear to be as good as any, when procurable. A fisherman in the *Field* observes that failing these he finds as the two best baits a peculiar red india-rubber eel on one line, and on the other a spinner with the back of the hook dressed with prepared fish skin and a piece of the same skin on the point of the hook, for which is substituted, when procurable, a slice from the tail of a longnose or mackerel. But it is not always easy to tempt a pollack with bait while pilchards are about.

Baits.—Sand-eels (*Ammodytes*) are their favourite bait, or an imitation insect known as "the Belgian grub," which is modelled in plaster on to the shank of a hook, and painted red and white; it is fitted with gut and a swivel. The end grub should be larger than the rest, with a piece of red india-rubber, resembling a brown elastic band, attached to the hook, and which, when drawn through the water, represents a wriggling sand-eel. Higher up, on two yards of salmon-gut, two or three smaller grubs may be placed without the eel, and attached like bob-flies on a casting-line. At the head of the gut should be a small swivel, then four or five yards of snooding attached to a coarser hand-line, which is wound round the usual square frame as a reel. At the end of the hand-line, or at its junction with the snooding, is strung a small leaden weight of two or three ounces, so that, while being dragged through the water, the lead may be near but not on the bottom, while the snooding and gut cast with the bait, being lighter, follow at a few feet distance above the rocks and weeds where the pollack like to frequent. The large summer pollack often refuse the "Belgian grub," and have to be tempted by live sand-eels or artificial white-flies. Cockles have been praised as a bait for ground fishing. On the Galway coast small fresh-water eels are said to be ingeniously fastened on to the hooks and used as a bait for this fish.

Breeding.—It spawns about the end or early part of the year, and the young are first seen at Mevagissey in April, about one inch long.

As food.—In the highest perfection in the autumn, especially those from about the end of Cornwall or off the Scilly Isles; it is superior to the coal-fish.

It is not seen much in the London market, but appears to be eaten on the coast where taken.

Mr. Dunn observes that porpoises will pursue both the young and full-grown pollack, and not long since the crew of a Mevagissey fishing-boat saw a school of the former attack one of the latter. After a short time full thirty large pollack were left for dead floating on the sea; they tacked their boat and picked up many of them.

Uses.—Oil is obtained from the liver off Scandinavia, where the "sey," or young pollack, gives about 26¼ gallons each 200 fish. Fishermen in Cornwall frequently salt and dry this fish for home consumption.

Habitat.—From the northern seas, extending along the coasts of Norway to the German Ocean and European shores of the Atlantic, becoming rare in the Mediterranean.

Although frequently met with in the Orkneys and Zetland, it is not so common as most of the cod family. At Banff frequent; St. Andrews, occasionally from the deep water; Firth of Forth, rare; in Yorkshire it is resident and common. At Lossiemouth examples are often taken during the summer and autumn months, especially among the coal-fish and in rocky localities. In fact, it is found on most of our rocky coasts, but most abundant along the south or south-west shores and bays, being numerous off Devonshire and Cornwall.

In Ireland it is common around the coast.

It is generally seen up to 6 or 7 lbs. weight; one has been recorded by Thompson of 12 lbs. from Belfast, while Couch asserts that his specimen weighed 24 lbs.

GENUS II.—Merluccius, *Cuvier.*

Geographical distribution.—Northern hemispheres on both sides of the Atlantic; also on the southern portion of the west coast of South America to New Zealand.

1. Hake (*Merluccius vulgaris*).

Names.—*The hake*, said to be sold in London as *Cornish salmon*, *Cegddu*, Welsh. It has also been termed *herring-hake*; *merluce*, or *sea-luce*, or *sea-pike.*

Hakes-teeth have been recorded as present in various soundings in charts of the sea; they consist mostly of a species of *Dentalium*, a shell having the popular name of "dog's teeth," and do not pertain to any fish.

B. vii., D. 10 | 36–40, V. 7, A. 36–38, Cæc. pyl. 1, Vert. $\frac{23}{26}$.

Length of head $3\frac{3}{4}$ to $4\frac{1}{3}$; height of body $6\frac{1}{4}$ to 8 in the total length. *Eye.*—Diameter $5\frac{1}{2}$ to 7 in the length of the head, 2 to $2\frac{1}{4}$ diameters from the end of the snout, and $1\frac{1}{2}$ to 2 apart. The lower jaw slightly the longer; the posterior extremity of the maxilla reaches to beneath the middle or hind edge of the orbit. No barbel below the chin. *Teeth.*—Large, acicular, in two rows, the inner of which is the larger, while the anterior ones are more movable than the posterior ones. In a **V**-shaped band on the vomer; none on the palatines or tongue. *Fins.*—The first dorsal, commencing above the base of the pectoral; a slight interspace between it and the base of the second dorsal, which reaches almost to the base of the caudal. Ventral, inserted a short distance in front of the pectoral: anal commences on a vertical line beneath the third or fourth ray of the second dorsal, and terminates below the end of the base of that fin. The vent is situated on a vertical line beneath the anterior rays of the second dorsal fin. *Lateral-line.*—Nearly straight. *Colours.*—Grayish along the back, becoming lighter on the sides and beneath, a purplish tint over the head and along the back. Fins dusky; base of pectoral, inner ventral rays, and anal, straw-coloured. A small black spot often present at the upper part of the base of the pectoral. Inner surface of mouth and gill cavities, black.

Varieties.—*Merluccius argentatus*, from Iceland, is said to have the inside of its mouth white, instead of black, and the second dorsal and anal fins notched about their centres.

Habits.—The hake is a bold and ravenous fish, a great wanderer, and rather uncertain in its movements, which seem to be sometimes due to being chased by sharks, porpoises, and other voracious inhabitants of the deep. Seasons, and the presence or absence of food, likewise affect the localities wherein it lives; thus during the summer it is often taken in bays, but in the winter more commonly in deep waters. It accompanies shoals of herrings and pilchards, on which it feeds, and Couch alludes to seventeen of the latter having been taken from the stomach of one of these fishes. Although present all the year round, it is in the autumn and winter months that the largest takes are made. At the end of January, or in February, they begin to go off their feed, due to spawning. In Donegal Bay hake-fishing commences in the month of September. In Devonshire, and along the south-west coast, this fish takes the place of the cod of the more northern counties.

Means of capture.—Line-fishing by night-time in mid-water, or beam-trawling during the day at the bottom, by which latter method some are also captured throughout the year. So common are they in certain seasons, that Couch mentions 4000 having been landed in one day in Mount's Bay; and on another occasion 1100 were taken by one boat in two nights.

Baits.—In some localities a slice from one of its own kind is found to be a good bait, but any that are suitable for the cod may be employed.

Breeding.—In the spring months, but may be delayed in cold seasons. Thus Couch remarks that in 1837 spawning in Cornwall was not accomplished until August. One, 12 lbs. weight, containing 15½ oz. of roe, was landed at Mevagissey the last week in February, 1882, the number of ova being upwards of a million and a half (Dunn). In the report of the sea fisheries of England and Wales for 1879, it is observed that at Mevagissey these fish have been falling off in numbers for the last fifteen years, due, it was surmised, to Plymouth trawlers catching hundreds of thousands of baby hakes, a foot or so long.

Uses.—Formerly they used to be salted in large quantities and exported, especially to Bilboa, in Spain. In this country salted hake used to be known as "Poor John." Even now they are extensively salted by fishermen, especially for their own consumption. They are more appreciated at present than formerly, as, due to the great price of fish, they are being forced into the market. Cornish observed, in 1878, that twenty years since *a burn* or "burden for one person" of twenty-one fish, obtained 3*s.* 6*d.*, a high wholesale price in West Cornwall. Now the price is 15*s.* to 20*s.* a burn, and the retail 1*s.* to 1*s.* 6*d.* each fish.

As food.—It is coarse, but at Plymouth all these slimy fishes, according to Yarrell, have the mucus first removed with hot water and a little alkali, otherwise they are spoiled. It may be cut into steaks and fried, or cooked in pies.

Habitat.—From the northern seas along the coast of Scandinavia, the German Ocean, and European shores of the Atlantic to Madeira, while it is also distributed through the Mediterranean, especially along its northern shores, and into the Adriatic. It is common in Greenland, but whether it is the same species which extends to Cape Hatteras appears doubtful, as in the American Fishery Reports it is recorded as *M. bilinearis* (Gill).

It is found around the British coasts, being much more numerous in some localities than in others. It is generally rare round Scotland, but recorded as present in the Orkneys and in Zetland; Banff; Aberdeen; in the Moray Firth during July and August, when it is found following the herrings. At Musselburgh one was taken in 1836, and sent to the Edinburgh market, where it appeared to be unknown. In Yorkshire it is resident, but seldom caught. It is occasionally seen on the Dogger Bank, but becomes more plentiful towards the coast of Holland. In February, 1847, one about 30 inches long was caught off Sherringham. It is, however, along the south and south-west coasts of England that this fish most abounds, becoming numerous in Devonshire and common in Cornwall, especially during the autumn and winter months.

In Ireland it is found all round the coast, but most common on the south. Off the coast of Waterford, on the Nymph Bank, there was formerly a large fishery for hake, which arrived in shoals twice yearly—June or the mackerel season, and September or the commencement of the herring season. In 1746, Smith, who wrote the history of the county of Waterford, complained that the fishery was declining. Thompson observed that he had been informed by Mr. Nimmo that upon the Galway coast, commonly in November, four or five men in one boat will take, with hand-lines, from 600 to 700; sometimes, but very rarely, 1000 are captured, but only when herrings are in the bay. The Bay of Galway, in old maps, is termed the *Bay of Hakes.*

The fish frequently attains to 4 feet. Mr. Dunn observes that the largest he has seen was 24 lb. weight.

GENUS III.—Molva, *Nilsson.*

Geographical distribution.—Marine fishes inhabiting the temperate waters of the northern hemisphere.

1. Ling (*Molva vulgaris*).

Names.—*Ling* is stated by most authors to be a corruption from "long," because this fish is similar in appearance to the cod, but more elongated. *Kellin*, Aberdeen; *lahan*, Moray Firth; *drizzle*, if small; it has also been known, according to T. Satchell, as *ling drizzle*, *olic*, *spotted ling*, *white-ling* and *stake*.

B. vii., D. 13–16 | 63–70, V. 6, A. 57–66, Cæc. pyl. 32, Vert. $\frac{37}{37}$.

Length of head 5; height of body 7 to 8 in the total length. *Eye.*—Diameter 5 to 7 times in the length of the head, 1½ to 2 diameters from the end of the snout, and 1 to 1¼ apart. The maxilla reaches to beneath the middle of the eye; upper jaw the longer. The mandibular barbel extends to beneath the centre of the orbit. Anterior nasal valve is prolonged into a short barbel. *Teeth.*—Cardiform in the jaws, with an inner row of rather widely separated and pointed ones in the mandibles; in a semicircular band on the vomer, among which a few pointed ones are interspersed; none on the palatines or tongue. *Fins.*—The first dorsal commences above the last half of the pectoral, while scarcely any interspace exists between its base and that of the second dorsal, which terminates close to the root of the caudal fin. Ventral jugular. Anal commences beneath the seventh or eighth ray of the second dorsal, and ends close below the base of the caudal fin. *Lateral-*

line.—At first descends slightly, becoming straight beneath the commencement of the second dorsal. *Colours.*—Back gray, becoming lighter on the sides and beneath; dorsal, anal, and caudal fins edged with white; a darkish blotch at the posterior end of the first dorsal fin, and a more distinct one at the end of the second dorsal. In the *young* the back and sides are yellowish-olive, broken up and divided into patterns by pale lilac lines.

Varieties.—Ogilby observes that a variety is common at Portrush, co. Antrim; "it is of a pale violet colour, irregularly mottled with dark purple, almost black spots, and grows to the same size as the usual kind; it is caught only on a particular part of the bank, and is called by the fishermen 'spotted-ling.' Similarly spotted ones are taken off the Cornish coast, and termed 'shipwrights,' due to their supposed resemblance to the spilt pitch on the clothes of these mechanics."

Habits.—A ground fish, preferring deep water and rocky places and caverns. It is very tenacious of life, and survives severe injuries. Mr. Reed took a salmon, 27 inches long, out of a ling 6 feet in length, captured off Wick. Couch found skulpins, *Callionymus lyra*, and even a "rough-hound" of considerable size, inside a ling. Like the pike of our fresh waters, this fish has the credit, which it apparently well deserves, of greedily bolting any sort of foreign substance it comes across. One was captured, some years since, off Brandon Head, county Kerry, inside which was a pewter flask, containing two glasses of ardent spirit. Another was taken on November 17th, 1881, which weighed 25 lbs.; in the stomach of this fish Mr. Boul, of Consett, found a three-gill bottle, some herrings, and a codling. There were also several pieces of parchment, and bits of sealing-wax, which induce the supposition that the fish had swallowed one of those mournful messages of shipwreck which have recently been so numerous.

Means of capture. — Hand-lines, also long-lines. The ling fishermen in Galway generally remain out a week, but every night seek shelter in a harbour in Boffin Island. In the north of Ireland ling and conger are generally fished for at the same time. In the Orkneys the long-lines contain several hundred hooks, placed at a certain distance apart, baited at night, examined and re-baited the next morning. It is by no means uncommon to find that dog-fish and sharks have cleared the lines prior to the fishermen's visit.

Baits.—A slice of plaice, flounder, herring, conger, or cuttle. Usually it refuses bait unless living or very fresh, while it does not appear to be partial to crustacea.

Breeding.—Spawns in spring up to June, Pennant observing that they "deposit their eggs in the soft oozy ground at the mouth of the Tees; and at that time the males separate from the females, and resort to some rocky ground near Flamborough Head, where the fishermen take great numbers, without ever finding any of the females or roed fish among them." After spawning, they remain out of condition till about August.

Uses.—When salted, ling is a considerable article of commerce, especially with Spain and Italy. When in season the liver is of a white colour, and affords a large amount of oil, which is used for lamps, medicinal, or other purposes. Their roe is consumed as food, or preserved in brine, and is often employed for attracting other marine fishes to localities where their capture would be facilitated. From the sounds or air-bladders of this fish a considerable amount of coarse isinglass is manufactured, similar to that btained from the cod. Ling split for curing should not be less than 26 inches from the shoulder to the tail, smaller ones being termed *drizzles*.

As food.—Is mostly preferred salted, and the periods for its capture are, in Zetland, from May 20th to August 12th; Yorkshire, from February to May, or even to the end of that month; January and February in the south-west of England, and March until May in the north of Ireland. Scilly has long been celebrated for its dry ling, and it may, perhaps, derive its name from *zilli*, being the Cornish term for this fish, though it is sometimes made to include the cod also. Rowell observes that when boiled it is much like cod, but firmer and whiter, and has a finer flavour; but to make a dinner of it, it should be baked, well seasoned with nutmeg, salt, and pepper, and a lump of the liver cooked with it. When thus prepared it makes a dinner one can eat with great relish, and feel very satisfied after it.

Habitat.—This species has been recorded from Spitzbergen to the extreme western portion of the Mediterranean, but is most abundant along the coasts of Northern Europe to Iceland, more especially in the German Ocean and off Norway. To the north of Iceland it becomes rare, neither is it abundant off Greenland and the Faroe Islands, while it is absent from the Baltic. It is found off Newfoundland.

This species of the Gadidæ, next to the cod and coal-fish, is the most common fish of the Orkneys. Large quantities are likewise taken off the western isles. It has been mentioned as being present at Wick, Banff, Aberdeen; common at St. Andrews. In the Firth of Forth it is taken with lines, principally about the Isle of May, where it is found more plentiful than further up the estuary. Occasionally small ones are met with near Inchkeith, but scarcely ever above Queensferry. Off Yorkshire it is resident and abundant: common in the Norfolk estuary, but not of large size; while along the south coast it is much more common in Cornwall than off Devon, becoming abundant off Scilly. It is found nearly all round the Irish coast.

Thompson records one of 59 lbs. weight from Ireland; Reed of an example 6 feet long, and weighing about 60 lbs, taken at Wick in March, 1872; Parnell heard of one which measured 7 feet in length, and Couch also was told of a Scilly example of 124 lbs. weight.

FAMILY II.—OPHIDIIDÆ, *Müller.*

GENUS I.—Ammodytes, *Artedi.*

The term Ammodytes refers to its power of digging the sand.

Geographical distribution.—Littoral and gregarious forms mostly of a small size, which frequent the sandy shores of Europe and North America, as far south as Cape Hatteras, while the late Dr. Jerdon discovered a species off Madras.

Of the three British species only a solitary example of *A. siculus* is said to have been dredged off the Shetland Isles, and is now in the British Museum, whereas *A. lanceolatus* and *A. tobianus* are common in suitable localities, but, being very similar in appearance, it often becomes difficult to decide to which of the two forms authors are alluding. I therefore propose bringing together in this place published accounts of the habits of the sand-eel or sand-launce generally. In May, 1870, Sars, when investigating the cod-fisheries off the coast of Norway, had his attention directed to the large number of schools of sand-eels, which during the winter months appear to reside in deep waters, as during those months they are occasionally taken from the stomachs of deep-sea fishes. As summer sets in they arrive in dense schools in the sandy bays and sounds, the places they frequent having been known from time immemorial, and being often very limited in extent. Exceedingly voracious, they devour any fish or other animal which they are able to overcome, while they likewise bury themselves in the sand, provided the weather is not too bright and sunny; consequently, when the tide is out, they may be dug up at even some considerable distance from the receding sea, although within the limits of tide-marks. Mr. Lloyd mentions that two kept in an aquarium at Hamburg always buried themselves in the sand at a particular spot, and, on being stirred up, they swam about with an uneasy and rapid wriggling motion for a few moments, generally with their heads towards the light, and then dashed down into the sand, into which they disappeared, prior to the subsidence of the little cloud of sand which they raised in the act of vanishing.

They appear to live in large schools, which have been observed to rise to the surface simultaneously, or when driven there by predaceous fishes. Thus Sars records seeing a flock of sea-gulls sitting listlessly on the edge of a rock overhanging the sea; suddenly, and as if with one impulse, all rose at the same moment and, screaming in concert, winged their way to a distant point where the sea looked like a miniature whirlpool. This was occasioned by the pollack, which had surrounded a school of sand-eels, and forced them towards the surface, when they became an easy prey, not only to these fish but to the gulls which swooped down from above. Porpoises have been recorded to act much in the same way, swimming round the schools and devouring immense numbers.

A. *Vomer armed anteriorly with a pair of tooth-like projections.*

1. Larger Sand-launce (*Ammodytes lanceolatus*).

Names.—Coast of Down in Ireland, termed *snedden*. *Horners*, or *horn-eels*, Edinburgh; *greater sand-eel*, Yorkshire; *great lant*, Cornwall. At St. Ives the fishermen term the adult *snake-bait*, and the young *naked-bait*; used to be termed *smoulds* in Norfolk. Yarrell suggested that the larger sand-eel only should be termed *sand-eel*, and the lesser one *sand-launce*. *Le lancon*, French.

B. vii., D. 53–58, A. 28–31, L. 1, 190–203, Cæc. pyl. 1, Vert. 67.

Length of head 4½ to 5¼; height of body 10 to 12 in the total length. *Eye.*—Situated a little before the middle of the entire length of the head, 2 to 2¼ diameters from the end of the snout, and 1 to 2 apart; lower jaw the longer, and having a soft prolongation in front; premaxillaries not protrusible; the posterior extremity of the upper jaw does not reach to beneath the eye. *Teeth.*—Absent from the jaws, tongue, and palate; the head of the vomer bifurcates into two tooth-like processes which project downwards and slightly outwards. *Fins.*—Dorsal low, and with an even upper edge; it commences on a line a little posterior to the hind edge of the pectoral fin, which latter is short, being only equal to about 3½ or 4 in the length of the head. *Lateral-line.*—Commences a little behind the head, is continued a short distance below, but parallel with the dorsal profile, and from it 190 to 203 folds of skin pass obliquely downwards. A second lateral-line runs from the lower
art of the base of the pectoral fin along the body a short
ce above the base of the anal fin. A straight line,
uscular insertions, passes from the head to the

centre of the base of the caudal fin. *Colours.*—Olive green, divided a little above the middle of the depth of the body, by a broad bright band, from a silvery abdomen. Dorsal and anal fins colourless; caudal with a dark base, and the central rays nearly white. A black blotch on the side of the upper jaw extending on to the cheek.

Habits.—This form keeps in deeper water than *A. tobianus*, while it is much more voracious; from the stomach of one, which was 12 inches in length, I took seven sprats from 1 to 2¼ inches long, and a lesser sand-eel 3 inches long. This fish does not object to devour its own kind. It appears to have derived its name, "horn-eel," from the sort of horny tip at the end of its lower jaw, which assists it when diving down into the sand, where it conceals itself during the ebb of the tide. Thompson remarks how he observed a number of pigs at Newcastle, county of Down, daily frequenting the sand at the extreme edge of the retiring waves, and ascertained that they were in search of these fishes. It has, however, been recorded as captured at the entrance of the British Channel, thirty miles from land and in forty-five fathoms of water. Frequently taken from the stomachs of larger fish, while its young is much relished by mackerel and herring.

Modes of capture.—The fishery at St. Ives, in Cornwall, commences in May and lasts until September. Thompson remarked as follows:—At Dundrum, on the coast of Down, from the loose sand covered with water, to about the depth of 9 inches, the persons engaged in this occupation with great dexterity drew these fishes from their hiding-places, using for this purpose old reaping-hooks. These are run through the sand with the right hand drawn towards the left, by which the fish is seized and transferred to a basket, strapped round the waist and carried in front. It is in shape like the angler's, but much larger and open at the top. Fishing here is daily carried on throughout the year except in winter, when, being full of spawn, they are rejected as food. In some places they are sought for by moonlight, and it has been said that their silvery brilliancy is more striking by night than by day. A rake is used in some parts, or a strong piece of iron wire bent into a sickle shape.

A writer ("Old Log") in the *Field* (June 18th, 1881) mentions that "When going fast through the water to get over some very unpromising ground, and our baits were nearly at the top of the water, I felt a very light bite, and, drawing in my line, found that I had got hold of a large sand-eel, whose mouth was little bigger than the baited hook. Now, according to all ordinary rules, the sand-eel should have been in or about the sand at the bottom, and yet he was foraging at the surface, and took a Belgian grub, which must have been a novelty to him."

Baits.—It appears to like live bait best, and objects to any if in the least tainted.

Breeding.—This may vary in accordance with the seasons in different localities. In August, at St. Ives, I found the roe similarly advanced to what I observed in *A. tobianus*, and conclude they both spawn in the autumn and winter months.

As food.—A very delicate dish, especially when in roe, but not good during the winter months, when it is thin and out of condition.

Uses.—As bait, for which its silvery appearance well adapts it.

Habitat.—From the Atlantic shores of Northern Europe
d coasts of the German Ocean, and very rarely found in
editerranean.

This form, although extended round the British Isles, is not so common as the smaller sand-eel, and seems to prefer deeper water. It is rare in the Orkneys and Zetland; common off Banff, Aberdeen. One example is recorded from the Moray Firth taken from the stomach of a cod. At St. Andrews it is frequent in the *débris* of storms on the sands, as well as in the latter near low water-mark. Bands of young occur in the tidal pools in May; not unfrequent in the Firth of Forth, Berwickshire, and in many situations along the east and west coasts of Scotland. In Yorkshire, common, but somewhat local; common in the Norfolk estuary; Suffolk; also along the south coast, as Sussex, Hampshire, Dorsetshire, becoming rarer off South Devonshire, and more or less common along Cornwall. Abundant in Guernsey, likewise taken in Somersetshire.

In Ireland it has been recorded from the north-east and west coasts, also probably in the south, but is rarer than the smaller species *A. tobianus.*

Thompson took one in Ireland 11 inches in length; another 13 inches long has been recorded; while Ray's example was 15⅓ inches.

B. *Vomer unarmed.*

2. Lesser sand-launce (*Ammodytes tobianus*).

Names.—Lesser sand-eel, Yorkshire; *lizard-bait,* by the fishermen at St. Ives. *Ornals* at Aberdeen; *the wriggle,* Sussex; *lant,* Cornwall; *saneels,* Moray Firth; *L'ammodyte équille,* French.

B. vii., D. 53–59, A. 26–30, L. 1, 125–145, Vert. 62–63, Cæc. pyl. 1.

Length of head 5¼ to 5⅓; height of body 7½ to 9⅓ in the total length. *Eye.*—Diameters 6 to 7 in the length of the head, 1½ to 2½ diameters from the end of the snout, and 1 to 1½ apart. Lower jaw projecting some distance beyond the upper, but not so much as in *A. lanceolatus.* The maxilla reaches posteriorly to beneath the hind nostril; premaxillaries protractile. *Teeth.*—None in the jaws; head of vomer forming a somewhat elevated transverse prominence, having a few deciduous teeth posteriorly, also a single similar row along the body of that bone; none on the palatines; a median row along the base of the tongue. *Fins.*—Dorsal commences above the origin of the last third of the pectoral. *Scales.*—Small, from 125 to 145 transverse and oblique folds of skin. *Lateral-line.*—The superior along the side of the back; the inferior along the side of the lower edge of the abdomen. *Colours.*—Upper third of the body olive-green; a silvery band, which widens and becomes more distinct posteriorly, passes along the side of the body, one-half below, the other half above the median line: below this band the abdomen is white. Fins unstained, except the base of the caudal, which is brownish. This fish is more silvery than the last species, and not so dark along the back, its colours having been well likened to those of the atherine or sand-smelt with its broad silvery lateral band.

Habits.—Appears to congregate in greater assemblages than the larger sand-eel, and to be seen more commonly nearer in shore, but it is not rare to find the two forms together.

Its head being small and muzzle sharp, it easily pierces the sand; while the body is square and slender, and so causes no obstruction to its progress; but, due to its many enemies, it always appears to be desirous of retreating rapidly into the sand. Porpoises, codfish, mackerel, &c.,

are constantly on the look out for it when the tide is high, and sea-birds when it is low.

This form takes to softer ground than the larger species. At the ebb of the tide it buries itself about a foot deep in the sand, remaining concealed there until the succeeding tide; occasionally at low water its snout may be perceived above the sand, or its hiding-place discovered by a little bubbling. Lightning is said to have a great effect in causing it to bury itself.

Means of capture.—Most sought for during spring tides (except in winter). They are obtainable for bait all along the south coast as far as the Scilly Isles, by those who have seines made for their capture, especially those of the Channel Island pattern, which have calico bunts or bags, by which the launce is kept swimming until they are dipped up and placed in the floating cases provided for keeping them alive.

"I was surprised to see the *Ammodytes* shovelled out from shelly and gravelly sand to a depth of 2 feet, on the surface of which my weight hardly left a footmark" (Thompson). They are most readily captured during frosts.

Breeding.—Various accounts have been given at what period of the year this takes place. Personally, at St. Ives, I have found examples of the small sand-eel with milt and roe very forward in the months of August and September. In Ireland Thompson found some ready to deposit their spawn at the end of July, but he remarks that in places they do so during the winter. Couch considered the end of December the most common period; so probably they continue spawning through the last few months of the year, dependent on the temperature, becoming very poor in winter after breeding. Their eggs are deposited in the loose sand.

Diseases, &c.—In July, 1881, the sea-shore between Burntisland and the East Neuk of Fife, on the Fife side, was literally strewn with dead sand-eels for several days. The cause was attributed to chemical agencies that flow directly into the Forth from the works along its margin.

Uses.—A capital bait, and much prized by sea-fowls. Couch remarks that he had been informed that if mackerel are found to be after this species of launce a more successful fishing is anticipated than if they are pursuing the larger sand-eels. It is said by Lloyd to be most difficult to keep alive in an aquarium. One summer at Hamburg he received twenty brought alive during a ten hours' voyage in a 10-gallon vessel of water. The creatures took an impetuous rush and a wriggle through the tank and turned up dead, some almost instantly and some a little later, with the exception of one which lived thirty-six hours. Subsequently he saw two living examples kept in a tank about 4 feet long and 18 inches deep, containing about 4 inches of sand at the bottom, but no other occupants, and the whole kept in a cellar.

As food.—Excellent eating, especially while in roe, but in winter, after spawning, it becomes thin.

Habitat.—Northern shores of Europe, and occasionally a few may stray into the Mediterranean.

Orkneys, in vast quantities. Edward recorded taking his first six examples, from 4 to 5 inches in length, at Banff in March, 1863; since then he has captured several, but always during the winter months, save one in the er; abundant, and used as bait in the Moray Firth. ews, occasional. Firth of Forth, plentiful during er months, especially on the sands above Queensferry, where the large sand-eel is never found. At Musselburgh and Portobello the two species inhabit the same locality. Yorkshire, resident and abundant; Norfolk estuary; in short, very common along the shores of Scotland and the east, west, and south coasts of England. On the south coast of Devon it is common, and used as food from May until October; abundant off some sandy bays in Cornwall, especially St. Ives, Guernsey, Somersetshire.

In Ireland common round the coast.

It attains to at least 7 inches in length.

B. Anacanthini Pleuronectoidei.

The structure of the head apparently unsymmetrical on the two sides.

FAMILY III.—THE FLAT FISHES *(Pleuronectidæ).*

The members composing this family are commonly known as *flat fishes*, but it must be observed there are two groups of "flat fishes," the one being, as it were, flattened from above, as we see in rays and skates, wherein the upper surface is the back. It is not so, however, among the Pleuronectidæ, or "side swimmers," which are compressed from side to side, except the head, which appears distorted and likewise flattened. When referring to the Pleuronectoids, the terms right (*dextral*) or left (*sinistral*) are employed with reference to the position of the upper or coloured side. To ascertain this, the fish is placed with its tail towards the observer, the dorsal or back fin above, and the anal beneath. *Reversed examples* are such as have the eyes situated on the side of the body, opposite to the one in which they are generally seen. *Double examples* are those in which both sides of the body are coloured.

The flat fishes are among the most remarkable of vertebrate animals, as for about a week or more after birth they swim on edge in a manner similar to other fishes, having their back fin above, their anal fin below them, and possessing an eye on either side of the head. But as they grow older this erect position becomes lost, their sides become their upper and lower surfaces, while both eyes are on the superior or coloured side of the body. The adult, when at rest or swimming, usually keeps near the bottom of the water, and progresses by means of a sort of undulating motion of the whole body, and of the unpaired fins. These fish are of a broad, flat shape, and margined in almost their entire extent by the dorsal, caudal, and anal fins; while not only the muscles, but the skin, the gills, gill-covers, and even the pectoral fin-rays, are less developed on the blind (or normally under surface) than on the coloured side, the mouth also being, as it were, bent round to this eyeless side, towards which the anterior part of the face seems to be twisted. From a very early age it had been known that these fishes when first emerging from the ova, and while in a pellucid condition, have an eye on either side of the head; that by degrees the eye, on what eventually will be the eyeless side, becomes depressed, while at the same time a dark spot appears on the opposite side of the head, so that the fish almost seems to possess three eyes. By degrees this dark spot becomes a distinct eye, while that on the other side gradually disappears; in short, the eye apparently migrates from what is henceforth known as the blind side of the fish. Professor Alexander Agassiz remarked that the first change and the process is identical, whether we take a right or a left flounder. First there is a slight advance towards the snout of the eye about to be rred, so that the transverse axis, passing through the pupil of the eyes, no longer makes a right angle with the longitudinal axis. This movement of translation is soon followed by a slight movement of rotation, so that when the young fish is seen in profile, the eyes of the two sides no longer appear in the same plane, that on the blind side being now slightly above and in advance of that on the coloured side. With increasing age the eye on the blind side rises higher and higher towards the median longitudinal line of the head. The back fin gradually extends towards the nostrils, and finds its way behind the eye which has come from the blind side. The eye is transferred at such an early period that the bones of the skull are cartilaginous, and the transfer is carried out by a combined process of translation and rotation. In some cases it was observed to be transferred, as described by Malm, round the head by the snout, and in others to actually pass through the soft tissues of the head, and this divergence appeared to be due solely to the generic differences in the position of the dorsal fin.

Some flat fishes have the eyes normally on the right side of the body, others on the left, but reversed instances, or those in which the coloured side is on that which is, as a rule, uncoloured, are not uncommon among most genera of flat fishes. Such is very frequently observed in flounders, these fishes, living close in shore, being more exposed to the actions of currents than those genera which live in the deep sea. In this way they become, in their very early life, forced on to the side which is not the normal one. Such variations are more commonly perceived in some localities than in others, and will generally be found due to local disturbing causes. Professor Agassiz kept young flounders in glass vases raised high above the table, and found that, notwithstanding the fact that here no disturbance could occur, seven out of fifteen were noticed endeavouring to force the eye round the wrong way by lying down on the opposite side. But all the seven soon died, and this may account for the comparative scarcity of reversed flat fishes. He also observed that the presence of light on all sides failed to arrest, or even to delay, the transfer of the eye, and the consequent change in the colour of the under side, which invariably became white with advancing age, when that organ passed over to the upper surface. Thus it would appear that the absence of light is not the primary or sole cause of the want of colour on the under side of the flat fishes.

While the eye is progressing from the one side of the head to the opposite, where it is to find its final resting-place, its course is occasionally arrested, and it may remain permanently stationary on the upper surface of the head, and this is commonly but not invariably seen in what are known as "double flat fishes," or those coloured on both sides. Double fishes have been observed in flounders, turbot, plaice, soles, &c., and they are seen to swim vertically, and to be more frequently found near the surface of the water than those which progress in a normal manner. All who have eaten these double flat fishes know how they are most deservedly held in greater estimation for the table than others which have an uncoloured as well as a coloured side. There are likewise albinos, or those which are uncoloured or nearly white on both sides (being almost or quite double albinos), and still retaining their normal form; but in some that have been carefully examined no sexual organs could be detected.

In the majority of albino examples only patches or
ns of the body are thus affected, and it has been
whether such may not, at least occasionally, be

due to a cross having occurred between a normal and a reversed example of the same species, giving rise to a sort of piebald colour.

Among these fishes it appears as if the female sex largely preponderated over that of the male. It also seems probable that their eggs float when deposited in the sea. In the earlier stages of their existence, during the spring months, flat fishes pass their lives close to the coast; they swim on the surface, and appear more active if the wind is setting in shore, perhaps taking advantage of it to return towards home.

Many legends doubtless are in existence throughout the universe regarding how these fishes became coloured on one side only. Klunzinger tells us that in Upper Egypt a tradition is prevalent that Moses was once cooking a fish, but by the time it had been broiled until it was brown on one side, the fire or the oil gave out. Moses, in a temper the reverse of amiable, threw the fish into the sea, where, although half broiled, it came to life again, and its descendants have up to the present day preserved the same peculiar appearance, being white or colourless on one side, and coloured on the other. In Constantinople a similar story is told of these fishes, but Moses retires in favour of the Sultan, Mohammed II., the conqueror of Stamboul. In the Isle of Man, Patterson states that there is a legend accounting for how the mouths of flat fishes became twisted. The finny tribes bethought themselves that it was time to select a king to decide disputes, and for which purpose they all assembled, putting on their best appearance. The plaice, however, remained so long at home adorning himself with red spots, in order to be selected their chief, that he did not arrive until all was over, and the shad had been elected "king of the sea." On hearing the result, the indignation of the plaice was aroused, and, curling his mouth to one side, he remarked with disdain, "Fancy a simple fish like a herring being king of the sea." And his mouth has continued awry ever since.

In some of the genera forming this family it is very interesting to observe the different plans on which the eyes are modified and protected. Thus the plaice or the flounder are able to move these organs horizontally, or even vertically, and it appears as if the two eyes, to a certain extent, act independently one of the other. In the turbot this organ can be covered, for not only does a thick skin invest the upper and lateral portions of the globe, as in most of the flat fishes, but being insufficient to protect the eye from the irritation of the sand wherewith it covers itself, it is able to elevate a thick lower eyelid, or else to depress the transparent portion of the globe of the eye beneath this fold of skin.

Respecting the means of capturing these fishes, it is found that they mostly reside in localities where the beam-trawl can be employed, while due to their great commercial value as food they are sought for throughout the year. It was observed at Great Grimsby during the cold winter of 1881, that the catch of soles had increased, as then they retired into deep water. By an old law of the Cinque Ports, no one might capture soles between the 1st of November and the 15th of March, neither was any one permitted to fish from sun-setting to sun-rising, that the fish might enjoy their night's food (Pennant, 1776). Constant complaints are heard respecting the diminution in the quantity of flat fishes, and the undersized ones that are sent to market. Off Great Grimsby these fish have decreased, so that the captures by each fishing smack are less than formerly, but the supply has been kept up by increasing the number of vessels. It has been suggested that beam-trawlers ought not to fish in water of less depth than twelve fathoms, or they would be injuring the brood-grounds. Once captured in a trawl, there would be but little use in returning the small fish to the sea, as they are usually too much injured.

Geographical distribution.—These littoral forms are mostly found where the sea possesses a sandy or muddy bottom, or else in muddy or sandy rivers, rarely existing at great depths, and but seldom frequenting rocky or precipitous coasts, while due to the deficiency of an air-bladder they live at the bottom. Flat fishes are numerous towards the tropics, where, however, they do not attain to so large a size as those which reside in temperate or cold regions; they are absent from very high latitudes. Some, as the common flounder, are anadromous forms, but the majority are strictly marine, while a few of the marine species have naturally, or consequent upon experiments made by man, been acclimatised in fresh water.

GENUS 1.—Hippoglossus, *Cuvier.*

1. Halibut (*Hippoglossus vulgaris.*)

Names.—Said by Ray (1713) to have been termed *but,* also *turbut* or *turbot; lady fluke. Turbot,* Moray Firth, also *bradan leathen,* or "flat salmon"; while at Aberdeen the large ones are called *turbot,* very old and black ones *blacksmiths,* and young ones *birdies.* Also known as *work-house turbot.*

B. vii., D. 99–107, V. 6, A. 73–82, Cæc. pyl. 4, Vert. $\frac{16}{34}$.

Length of head $4\frac{1}{2}$; of caudal fin $6\frac{1}{2}$; height of body 3 to $3\frac{1}{4}$ in the total length. *Eye.*—Diameter $5\frac{1}{2}$ to 6 in the length of the head, and nearly or quite equal to the extent of the snout, and from ¾ to 1 diameter apart; anteriorly the two eyes reach to the same level. Lower jaw prominent, the posterior extremity of the maxilla reaches to beneath the middle or hind edge of the orbit. *Teeth.*—Conical in the jaws. *Fins.*—The dorsal commences above the first third, or middle of the upper orbit, and terminates before it reaches the caudal fin. Pectoral on the coloured side half as long as the head, slightly shorter on the blind side; ventral short, being scarcely half the length of the pectoral. *Scales.*—Minute, and cycloid over the body and head. No spine in front of the anal fin. *Lateral-line.*—Anteriorly curved above the pectoral fin, the height of the curve being about equal to one-fourth of its length. *Colours.*—Right or coloured side of an olive marbled all over with darker; fins similarly coloured except in the young, when the basal halves of the dorsal and anal are light coloured.

Habits.—This is the largest form of the family taken off the British shores. It feeds close to the ground, but often inhabits deep and rocky situations, while Lacépède observed that in Greenland it appeared to prefer localities also frequented by the cod, as they probably seek the same food. Pennant remarked (1776) that during the preceding year there had been two instances of halibuts swallowing the lead weight at the end of lines with which seamen were sounding, one occurring off Flamborough Head, the other when going into Tinmouth Haven. Thompson took from the stomach of one weighing about 120 lbs. the remains of a ray; from another ten full-grown sprats, and a fragment of *Millepora polymorpha;* another was crammed with crabs, nd a valve of *Venus cassina*. On the Dogger Bank it is d to consume large quantities of shell-fish, also flat fish stacea.

Means of capture.—Baits employed on very strong hooks and lines, as it sometimes offers a determined resistance, and which may be very formidable in large examples. This, however, according to Thompson, is not in accordance with the experience of Irish fishermen, who assert that it is a simple fish, easily killed, and they never lose one in consequence of its weight. Off Ireland it is generally taken on cod lines, the whelk, *Buccinum undatum*, being mostly employed as a bait. In the Orkneys it is most commonly captured in the slack water and eddies occasioned by the various islands in the race of the tides.

Baits.—Generally those employed for the cod and turbot. In the Moray Forth a piece of plaice is mostly used.

Breeding.—April in Cornwall; off Scotland in the spring. The roe is of a pale red colour, and the ova very numerous.

Diseases.—Thompson states that upon all he has examined were specimens of the parasite *Hirudo hippoglossus*, Müller; and McIntosh remarks that *Epibdella hippoglossi* is often seen on the caligus of this fish, in fact *Udonella caligorum* is common.

Uses.—Said to be more famed for its size than for its quality, and is sold throughout the year, except during May and June.

As food.—It is little esteemed in England, and does not obtain a ready sale among the general public, unless other fish is scarce. Mr. Rowell, however, observes that at Newcastle they are termed "turbot," and greatly esteemed, and as a test observes cod is retailed at 4*d.* a pound, ling at 5*d.* or 6*d.*, and halibut at 10*d.* or 1*s.*, these three prices showing their respective local estimation.

Jews are frequent purchasers of halibut, but they must have an entire fish with its head and gills intact. Thompson considered it very good for the table. Lowe asserted that it is a large, coarse, and dry fish, except the head and fins, which are reckoned excellent, while a small one is far from bad. The skin is thick and oily, as are also the bones, from which latter a quantity of pure oil may be obtained. The Greenlanders are said to cut them into large strips, which are dried in the sun.

Habitat.—From the coasts of Spitzbergen to Iceland, Finland and Scandinavia to the British and French shores, but it is rare in the Channel. It is abundant off the Orkneys, especially in eddies or where two tides meet. One captured in such a locality was 7½ feet long, and thick in proportion. It is also common in Zetland. Frequently met with along the east coast of Scotland, and thrives on the immense sandy plain between there and Norway. Reid has obtained it up to 231 lbs. weight at Wick; also found in the Moray Firth, more particularly during the month of March; at Banff in deep water; while it is not rare at St. Andrews. Resident off the Yorkshire coast, and in moderate numbers, but seldom caught now, at Flamborough, where thirty or forty years ago it was very numerous. In the Norwich papers of February 15th, 1873, one is mentioned as having been taken off Yarmouth measuring 5⅓ feet long, 2½ broad, and weighing 7¼ stone; and Buckland instances another, 6 feet long, weighing 161 lbs., obtained from the same locality in 1867. In the *Norfolk Chronicle* of April 29th, 1876, it is recorded that Messrs. Parker exhibited a halibut from the deep sea off the eastern counties, weighing over 300 lbs., and above 7 feet in length. It has been captured off Sussex; is occasionally taken off Devonshire, but not sought after. On April 14th, 1870, one weighing 102 lbs. was secured at Mevagissey. It is not common off Cornwall, but has been taken up to 122 lbs. off Land's End, and one weighing about 1 cwt. is recorded by Mr. Cornish in the 'Zoologist,' as captured on a spiller in Mount's Bay, on May 15th, 1882. Pennant mentions it from the Menai Straits, and in April, 1829, an example 7¼ feet long and 320 lbs. weight was recorded from off the Isle of Man, and is perhaps the example stated by Parnell to have been sent to the Edinburgh market.

In Ireland.—It is taken occasionally on all parts of the coast from December until March. In Portrush, county of Antrim, it is occasionally captured in winter on the cod lines, baited either with the whelk or the flesh of various fishes, chiefly wrasses.

It attains to at least 500 lbs. weight in Europe. Olfsson mentioned one exceeding this from Iceland, and which was said to have been little short of 20 feet in length, while Couch was informed of a still larger example captured on the banks of Newfoundland.

GENUS 2.—Hippoglossoides, *Gottche.*

1. Long-rough dab (*Hippoglossoides limandoides*).

Names.—Rough dab or *long-rough dab; bastard-sattie,* Aberdeen; also *yellow dab,* Banff; *long fleuk* and *sand-sucker,* Edinburgh, the last name being due to the erroneous idea that it feeds on nothing but sand.

B. viii., D. 76–87, V. 6, A. 60–69, L. l. 85–95, Cæc. pyl. 4, Vert. 45.

Length of head 4⅔ to 5; height of body 3 to 3¼ in the total length. *Eyes.*—Divided by a narrow but scaled ridge, diameter about one-fourth of the length of the head and nearly 1 diameter from the end of the snout. The anterior margin of each eye is on the same vertical line. Cleft of mouth deep, the maxilla reaches posteriorly to beneath the middle of the orbit, the lower jaw the longer. *Teeth*.—Pointed, the anterior being the longest, the front ones are placed somewhat distantly apart, and in one row in each jaw. *Fins*.—The dorsal commences above the first third of the upper eye, but is not continued so far as the base of the caudal fin, its rays are simple, and the longest are situated about midway between the hind edge of the head and the base of the caudal fin. The anal has a short spine directed forwards at its base, just where it commences on a vertical line beneath the middle of the pectoral; it ends similarly to the dorsal: its highest rays are slightly below the centre of its length, and are similar to those of the dorsal fin. Caudal wedge-shaped, its central rays being slightly the longest. Free portion of the tail two-thirds as long as high. *Scales*.—Ctenoid, covering head, including jaws and body, as well as a row on each fin ray. *Lateral-line*.—Nearly straight anteriorly, becoming quite so opposite the hind end of the pectoral fin. *Cæcal appendages*.—Four. *Colours*.—On upper surface of a pale brownish grey or sandy; under surface white. Occasionally it is said to be slightly spotted.

Habits.—It frequents sandy shores, is captured along with plaice and other Pleuronectoids, and, according to Parnell, several may be daily found in the Edinburgh markets from May to July. Parnell obtained what appeared to be fragments of some species of *Asterias* in the stomach of one he examined. Cock's specimen had its stomach filled with the shells of *Turritella terebra*, two-thirds of which contained hermit crabs (*Pagurus*).

Means of capture.—It appears to be usually taken with the beam-trawl.

Breeding.—In May and June.

Food.—Its flesh is sweet and good, but rather dry.

Habitat.—Atlantic coasts of North Europe and shores of the German Ocean.

It is rare off Banff; captured at Aberdeen; frequent during May, June, and July in the Firth of Forth; not rare off Berwick; Sunderland; inhabits deep waters in the North Sea, and is occasionally taken at Whitby and Hastings; common in Devonshire.

In Ireland Mr. Todhunter obtained a specimen off Cape Clear in the winter of 1848, and which is now in the Dublin University Museum.

The largest British specimen recorded measured 15 inches in length.

GENUS 3.—Rhombus, *Cuvier.*

1. Turbot (*Rhombus maximus*).

Names.—*Turbot*, formerly spelt *turbolt*. *Rod*, Orkneys. *Roddan* or *roan fleuk*, *barnock* (from its round shape) and *gunner-fleuk*, or *fleuk*, east coast of Scotland. Neill observes that it is termed *rawn fleuk* or "fleuk in roe," because it is deemed best for the table when in "roan" or "roe." *Brat*, *turbrat*, or *roddams*, Northumberland. In Cornwall, according to Borlase, it used to be termed *brett;* in an old Cornish journal it is called *luggatee*. *Birt* or *byrte-fish*, or *breat.*

B. vii., D. 61–72, V. 6, A. 45–56, Vert. $\frac{13}{18}$, Cæc. pyl. 2.

Length of head $3\frac{1}{8}$; height of body $1\frac{3}{4}$ to 2 in the total length. *Eyes.*—Diameter, one-sixth to one-tenth of the length of the head; one transverse diameter apart; lower eye half a diameter in advance of the upper eye, and $1\frac{1}{4}$ to $2\frac{1}{8}$ diameters from the end of the snout. Not only does opaque and thick skin cover the upper and lateral portions of the eye, but it can raise over it a thick lower eyelid, or else depress the transparent portion of the globe below this fold of skin, irrespective of which a portion of the iris forms a semilunar veil at the upper part of the pupil. Cleft of mouth deep, oblique, lower jaw the longer. *Teeth.*—Small, numerous, and in several rows in both jaws. *Fins.*—Dorsal commences on the snout in advance of the eyes; at first low, its rays increase in length to just beyond the centre of the fin; from thence they gradually decrease, ending a very short distance from the base of the caudal fin. Ventral commences under the throat, its longest rays equal two-thirds the length of the pectoral. Anal commences slightly before the base of the pectoral. Caudal rounded. The skin on the coloured side is studded with numerous bony tubercles, the blunt points of which are directed forwards, those on the head are smaller than those on the body. *Lateral-line.*—With a curve anteriorly, and becoming straight opposite the posterior end of the pectoral fin. *Colours.*—Superiorly sandy-brown, covered with more or less distinct dark spots and blotches, these being likewise continued on to the fins, giving them a mottled appearance. Under surface of the body white.

Varieties in form.—Examples are occasionally met with having a notch or depression at the summit of the head. McIntosh figures an abnormal form, and in his account of the fish of North Uist, observes upon one with an eye on either side of its head, as shown in *Pleuronectes cyclops* of Donovan. Couch instances a turbot coloured on both sides, in which a process three inches in length, thin in substance, and nearly as broad as a finger, projected from before its eyes, and was not connected with the fin rays.

In colour, varieties are numerous; there are such as are partially albinos; also reversed and double ones. On 2nd August, 1874, a double one weighing 11 lbs. was n at Montrose, where, remarks Mr. Johnson, "we see ometimes in the course of the year two or three of them, and then for years won't see any." It has been observed that these fish from our northern coasts and brought by the Dutch, are darker than those from the south-west coast of England.

Habits.—Frequents sandy bays and likewise muddy localities; it appears to constantly change its residence, migrating into deep water during cold weather similarly to the soles. It is very retentive of life when captured. Its principal food is small fish, crustaceans and molluscs. In an example captured in Torbay, which Mr. Gosden, of Exeter, examined when quite fresh, he found Montagu's crab (*Xantho florida*), the angled crab (*Gonoplax angulata*), velvet fidler crab (*Portunus puber*), the long-haired porcelain crab (*Porcelanus longicornus*), the olive squat lobster (*Galathea squamifera*), the spider crab (*Stenorynchus phalangium*), brittle starfish (*Ophiostrix fragilis*), and the *Eurynome aspera.* Pontoppidan remarks that it feeds on young crabs and small fishes, sea eggs or sea urchins, of which it is very fond.

The turbot was formerly preserved by the Romans in salt-water ponds, so as to be readily available for the market. The largest appear to have been preferred, and it has been asserted that the Emperor Domitian convened the senate respecting how a mighty fish of this kind should be cooked. Respecting the food of the turbot and flat fishes generally, it is often difficult to institute investigations, as they are generally at once disembowelled by fishermen when captured, because after death decomposition rapidly attacks their intestines, and injures the fish in a very few hours. By Act i., c. 28, of George I., a turbot under 16 inches long, brill under 14, codling 12, whiting 6, bass and mullet 12, sole 8, plaice or dab 6, and flounder 7 inches long, were forbidden to be sold.

Means of capture.—At the commencement of the season it is taken by trammel and beam-trawl nets, but as the fish retires to deeper water and rougher ground, long lines or boulters are employed; off the Dutch coast in warm weather they are taken in very shallow water. In calm weather, when the sun is bright, it may be speared. In county Down fishermen employ a spear thirty-two or thirty-three feet long, armed at its extremity with an iron barb; the fishermen even drive it down on them when beyond their reach. In many places fishing for turbot with long lines has had to be discontinued owing to their being destroyed by steam-trawlers, while in several localities these fish, which used to be abundant, have almost disappeared. It is to be regretted that numbers of the young of these fish are destroyed by trawlers, or inshore nets having a small mesh as used by shrimpers.

Baits.—These must be very fresh, alive if practicable, and shining if possible; the lampern is deemed one of the best, and largely used by the Dutch. In the Moray Firth, during July and August, it is often captured with herrings or sand-eels used as a bait. It will take a slice of fresh fish as those named, also *Cottus*, haddock, mackerel, pilchard, sand smelt, garfish, and likewise worms, mussels, limpets, or even bullock's-liver.

Breeding.—Breeds in summer; in February it has been found with nearly mature ova; a male had milt only two-thirds ripe, April 12th, 1883. This fish has a large number of very small ova, and in a 23 lb. fish, which had a roe weighing 5 lbs. 9 oz., were 14,311,200 eggs.

Hermaphrodites.—Quelch published a description of a supposed hybrid between this fish and the brill, *Rhombus* *lævis.* Messrs. Pile reported to *Land and Water* from Dublin having obtained a similar hybrid weighing 17½ lbs. "It had the ordinary large turbot head, fins, and unusually large 'wings,' but the belly, though quite white like the turbot, had large scales on it not unlike brills, the back was of a very dark colour, and covered with small lumps. The fish was fully matured, and in splendid condition."

Life history.—The young turbot swim for a longer period on edge than the generality of our flat fishes. For the first month they are quite black, and swim on edge like a John Doree. Then their skin commences to mottle with white and brown, and their right eye begins to pass over to the left side of the head. Next they become white underneath, and of a light leaden colour on the upper surface, and during the time they remain of this shade on the back, which is until they have passed two months of age, they swim on the surface of the sea. If they descend to the bottom during this period it can only be occasionally. What the rate of growth of these fish is, very different opinions may be given. Some young, measuring 3 inches across, were obtained from shrimpers and placed in the Southport Aquarium. In two and a half years they had attained to 10 lbs. each in weight; after two years more they further augmented to 20 lbs., or an annual average increment of about 4½ lbs. each.

Uses.—A large proportion of our turbot are taken along our east coast, on or near the various sandbanks. But the Dutch are more successful at capturing this fish than our native fishermen, and are estimated to supply one-fourth of the quantity which is consumed. Their fishing commences about the end of March, a few leagues to the south of Schevelingen. As the warm weather approaches the fishery is gradually advanced to the northwards; and the fishing terminates about the middle of August. The Dutch were computed to have realized £80,000 yearly by the sale of turbot to the London markets, and the Danes £10,000 to £15,000 per annum for lobsters wherewith to form the sauce.

As food.—The most highly valued among flat fishes. In L'Estrange's 'Household Book,' sixteenth century, the merits of the turbot appear to have been recognised: one is mentioned as purchased for two shillings and fourpence, while ten plaice cost but tenpence. Rutty, in 1772, says it used to be termed in Dublin "the pheasant of the water." Low, in the Orkneys, that it is a much better fish than the halibut. If at all tainted, it is liable to occasion nausea and sometimes severe symptoms.

Habitat.—The coasts of the northern seas of Europe, plentiful in the German Ocean, and extending to the seas of Britain and round the coast of France, and through the Mediterranean to the Adriatic.

Not rare in Orkney and Zetland; found at Banff and Aberdeen; common at St. Andrews; but large ones are rare until the English coast is approached. A considerable fishery exists along Berwickshire, Northumberland, and Yorkshire.

Resident off the coast in moderate abundance in Yorkshire; rare in the Norfolk estuary; very fine ones are taken at the back of the "Falls" near Margate; in the vicinity of Dover, the Varnæ, and the Ridge sandbanks, the first about seven miles distant and the latter about twelve on the French coast, also afford good fishing ground at certain seasons for these fish. A considerable amount is likewise captured off the Devonshire coast, where, however, it is not so common as off Yorkshire; in Cornwall not uncommon; ptured in the Bristol Channel.

In Ireland it is taken round the coast, and is plentiful to the north.

As to the size it attains in this country, accounts vary, as in some places the halibut is termed a turbot. Thompson mentions one 44½ lbs. weight, captured in a trammel in four fathoms of water at Springvale, county Down. Buckland took a cast of one which weighed 32 lbs. Parnell records on hearsay one weighing 190 lbs., and Couch possessed a note of one 70 lbs. in weight.

2. Brill (*Rhombus lævis*).

Names.—Pearl, *kite*, *brett*, "brit" in Cornish means "spotted." Upon the coasts of Devonshire and Cornwall it is known by the name of "kite" (Pennant, ed. 1812); *Bastard turbot*, Moray Firth; *siller fluke*, Aberdeen; *bonnet fluck*, Aberlady Bay; used to be termed *lug-a-leaf* in Cornwall (Willughby).

B. vii., D. 76–85, V. 6, A. 53–63, L. 1, 150, Cæc. pyl. 2, Vert. $\frac{13}{24}$.

Length of head 3¾ to 4½; height of body 2 to 2½ in the total length. *Eyes.*—On the left side, the lower half (quarter in the young) in advance of the upper; 1 diameter apart. Its eye externally is similar to that of the turbot. Lower jaw projecting and the longer; the maxilla two-fifths the length of the head, and reaches to below the posterior third or hind edge of the lower orbit. *Teeth.*—Small ones in jaws and on vomer, none on the palatine bones. *Fins.*—Dorsal commences on the snout, its first few rays having broad fringes which divide so as to give them a brush-like appearance; its rays are branched, and the longest behind the middle of the fin. Caudal rounded. *Scales.*—Small, cycloid, continued on to the head and vertical fin rays; no tubercles on the body. No spine before the anal fin. *Lateral-line.*—With a strong curve anteriorly reaching to some little distance beyond the extremity of the pectoral fin, when it becomes straight. *Colours.*—Of a sandy brown on the left side, usually speckled with white or light dots or spots; fins slightly marbled. Under surface white, with sometimes a few black or gray spots along the bases of the vertical fins.

Varieties.—Apparent hybrids between the turbot and brill have been alluded to. Yarrell figures the deformed head of one of these fish. Double brill are not rare; also reversed and albino ones are occasionally observed. Thompson mentions an example which was covered over with large stellate, white markings on a very rich-coloured dark "ground," looking precisely as if a shower of snow had fallen on it. Couch remarked upon having seen an example intensely black, with a few white specks on the anal fin.

Habits.—Found in sandy bays, also in deep water, and occasionally enters the estuaries formed by large rivers. It feeds on crustacea, small fish, and food similar to that consumed by the turbot.

Means of capture.—Similar to what are adopted for the turbot. In the Firth of Forth it is mostly taken by the hook, but not so along the Cornish coast.

Breeding.—In spring.

As food.—Abundant in our markets, but not held in so much esteem as the turbot, yet is superior to the plaice. In Ireland it is most valued in spring.

Habitat.—Coasts of Europe, becoming rarer towards the north. It is found round the British Isles, and through the Mediterranean. It is rare in the Orkneys and Zetland; off it is taken at Aberdeen; is found occasionally in the Moray Firth, while it is abundant at St. Andrews. Neill records it at Aberlady Bay, Parnell in the Firth of Forth, while off Yorkshire it is resident and not uncommon; it is found generally along the east coast, becoming, however, abundant along the south coast.

In Ireland it is common round the coast, being taken with, but much more abundantly on sandbanks than the turbot, on the north-east coast in the proportion of at least four to one.

As to the size it attains on our shores, Yarrell states that it rarely exceeds 8 lbs. in weight, Parnell 10 lbs., while Thompson's finest example was 2 feet in length.

GENUS 4.—Zeugopterus, *Gottsche.*

1. Müller's and Bloch's Topknot (*Zeugopterus punctatus*).

Names.—Browny in Cornwall; *little black hairy fluke*, Edinburgh market.

B. vii., D. 87–101, V. 6, A. 69–80, Vert. $\frac{12}{25}$, Cæc. pyl. 0.

Length of head $3\frac{1}{2}$ to $3\frac{2}{3}$; height of body about 2 to $2\frac{1}{4}$ in the total length. *Eyes.*—On the left side, upper margin covered by a thick skin, the lower slightly in advance of the upper, 1 diameter from the end of the snout, and one-fourth to one-fifth of the length of the head. Cleft of mouth very oblique, the lower jaw rather projecting anteriorly. *Teeth.*—In a villiform band in the jaws, present also on the vomer. *Fins.*—Dorsal commences on the snout, its anterior rays not so long as the diameter of the eye; they gradually increase in length, becoming longest in the commencement of the last third of the body, where they equal half the length of the head; the posterior ones short, and the fin passing beneath the base of the caudal becomes almost conjoined with the anal, which is similarly turned under the tail. Ventral, commencing under the throat, is joined posteriorly to the anal; the skin from this fin passes to the posterior surface of the base of the anal rays, a groove being formed for the vent. Caudal rounded. *Scales.*—Spinate on the coloured side, present on rays of vertical and caudal fins. Smooth on the blind side. *Lateral-line.*—Forms a curve over the base of the pectoral fin, after which it becomes straight. *Colours.*—Of a rich dark brown, having a wide black, light-edged band passing backwards and outwards from each eye. Three or four round black marks on the back, and some irregular dark blotches, and occasionally numerous light spots. Jaws blackish. Fins dark brown, with some irregular bands and blotches, more especially on the dorsal or anal. Under surface white.

Varieties.—According to Mr. R. Couch, this fish is very subject to malformation of the anterior end of the dorsal fin, causing it to form an arch over the eyes. J. Couch observed upon having seen this fish with almost the whole of its upper surface, except the head and a small patch near the tail, without colours or scales, like the lower surface; the border of the dorsal and anal fins yellowish red, and with only two or three rays having scales; on the tail the rays extended beyond the border of the membrane. In another instance there was no caudal portion, so that where the dorsal and anal fins were brought closely together the body terminated.

Habits.—Frequents sandy bays having low shelving rocks covered with seaweed, and here it conceals itself. In an aquarium it conceals itself very effectually.

Means of capture.—Trammels. In the Firth of Forth occasionally taken in crab-pots.

Breeding.—Summer and autumn and in winter the young are of about 1 or 2 inches in length, and may occasionally be found under stones at low water-mark.

As food.—Mr. Cornish found its flesh to be excellent.

Habitat.—From the coasts of Northern Europe, round Great Britain to France, where, however, it is very rare.

Round the British coast it is by no means rare, and even common off Cornwall. Several examples have been obtained in the Orkneys; it occurs at intervals off Banffshire and along the whole line of coast; Aberdeen; not common at St. Andrews; Firth of Forth, where Parnell observes that it is rarely seen except during stormy weather; off Berwickshire rare. Mr. Anderson Smith obtained three examples in 1882 from Loch Creram in Argyllshire. Two examples taken in February, 1852, at Redcar (Rudd, 'Zoologist,' p. 3504), and a third recorded by Ferguson; also, in 1836, several found there on the beach, but none for the succeeding eight years; in fact, it is of rare occurrence in Yorkshire; one at Bridlington on May 27th, 1881; the Medway. Along the south coast it has been very frequently taken; at St. Leonards, in 1872; August 23rd, 1865, one at Boirsand, Devon, another March 12th, 1873; while off that county it is frequent during the spring months; at Weymouth, in August, 1854, a fine example was taken by a trawler; off Teignmouth, in January, 1843, one 6⅛ inches long was captured in a drift-net. Mr. Cornish, recording one taken in May at Penzance, remarked that he had obtained forty-eight examples since 1858. Bristol Channel; Swansea and Anglesea.

In Ireland, one 6⅛ inches in length was taken March 25th, 1835, at Ardglass, co. Down; September 30th, 1842, Dr. Ball obtained one 7¾ inches long off Kingstown Pier; two more were purchased in the Dublin market and sent to the University Museum; in 1865 one was captured in the winter (Blake-Knox, Zool., 1866, p. 508); in 1853 another, 5¼ inches long, at Dalkey Sound, in eight or ten fathoms of water, and presented to the Dublin Natural History Society (Kinahan, Zool., 1853, p. 3990).

In British waters this fish attains to 7 or 8 inches in length.

GENUS 5.—Pleuronectes, *Artedi.*

As bait for these fishes on foul ground, lug-worms and pieces of the flesh of the conger or herring are much used. But the majority along the British coasts are obtained by means of the beam-trawl. I shall defer the consideration of this mode of fishing until arriving at the more valuable genus of Solea.

1. Plaice (*Pleuronectes platessa*).

Names.—Plaice, diamond plaice, Sussex, from its lozenge-shaped spots. *Plash fleuk*, Moray Firth. *Fage* or *facq*, Anglo-Saxon. *De schol*, Dutch. *La Plie Franche* ou *Carrelet*, French.

B. vii., D. 66–77, V. 6, A. 50–57, Vert. $\frac{14}{29}$, Cæc. pyl. 2 (3–4).

Length of head 4⅓; height of body 2⅔ in the total length. *Eyes.*—On the right side, the lower one-fourth to one-half in advance of the upper, nearly 1 diameter from the end of the snout, while the two are divided by a narrow smooth ridge. Lower jaw in advance of the upper, with a knob at the symphysis; the length of the maxilla equals that of the orbit, while it reaches posteriorly to beneath the first third of the eye. *Teeth.*—Compressed and truncated at their summits, 20 to 24 in the upper on the blind side, those on the other side being few and smaller; those in [illegible] similar to those in the upper. *Fins.*—The dorsal commences above the middle of the eye, and ceases a little before the base of the caudal fin, the distance being less than the depth of the free portion of the tail below it; caudal rounded. A spine, directed forwards, is situated just before the base of the anal fin. *Scales.*—From 90 to 100 rows, cycloid; some on cheeks, none between the eyes. None along bases of dorsal and anal fins. *Lateral-line.*—Slightly curved above the pectoral fin, the extent of the depth of which is less than the width of the base of the pectoral fin; the greatest depth between its straight portion and the anal fin is less than the length of the head. *Colours.*—Of a chestnut or rich brown on the right side, covered with large orange and sometimes black-edged spots.

Varieties.—Buckland mentions a variety destitute of spots. Reversed examples are not rare, piebald ones common. These fish rapidly assume the colour of the ground on which they are residing.

Habits.—In the Orkneys it keeps much to sand-banks and muddy ground. During the summer months on the east coast of Scotland it appears to frequent rocky localities, but in February and March seeks sandy places where it can deposit its spawn. In Cornwall it has been observed to select water of a moderate depth, and in May to arrive inshore; also in the autumn it is found in shoals in the quiet bays, but when the frost sets in it retires to the deep. When disturbed it will shoot away suddenly for a short distance, and can work itself rapidly into the sand, where it lies concealed with only its eyes being apparent. Has great tenacity of life; one 10 inches long taken in January lived thirty hours after removal from the water; it was kept ten hours in a very warm room, where it lay all the time on a dry plate.

Thompson found in the intestinal canal of some taken in Belfast Bay, *Tellina tenuis*, fragments of *Mactria solida* and common mussel (*Mytilus edulis*). In June, large ones contained some sea mice (*Aphrodita aculeata*), portions of whelk (*Buccinum undatum*), with the remains of *Decapod crustacea*, and in April, *Lucina radula*, &c.

In East Friesland it has been transferred to fresh-water ponds, where it thrives.

Means of capture.—In the Orkneys "a few are caught on small lines made on purpose; but they are not much sought after." Around the British coast they are taken by lines or beam-trawls. Spillers, also, are shot in sheltered sandy bays, the bait employed being the lug-worm or a mollusc removed from its shell.

They are speared in the seas of Northern Europe, where the water is very clear, heavily-leaded, doubly-barbed spears being employed, according to Pontoppidan.

Breeding.—The plaice appears usually to breed about February and March, but sometimes in autumn and early winter. On February 4th, 1882, I obtained a male, which weighed 1¼ lbs., full of milt. Mr. Jackson, in sending some ova of this fish to Mr. Buckland, remarked that they were obtained from a ripe and enormously distended female in one of the tanks in the Southport Aquarium. The ova ran freely, and at first floated on the surface, but when the vessel was perfectly still they slowly settled to the bottom. The slightest motion of the water occasioned them to float. The young are first seen in April, close to land, swimming on the surface of the sea, on their edge, with an eye on each side. In about a week after being first seen they may be found in pools near the shore, about the size of a baby's finger-nail. A plaice which weighed 4 lbs. 15 ozs. contained 1 lb. 9 ozs. of roe, or 144,600 eggs, which were of a large size as compared with those of the turbot. Thompson observed obtaining examples 3 inches long in January, 1835.

Life history.—The opinion was formerly entertained that the plaice is descended from a shrimp, and Dr. Deslandes investigated the subject. He first placed some of the shrimps in a vessel of salt water, and after twelve or thirteen days he discovered eight or nine young plaice. The next year he placed some plaice in two different salt-water receptacles, and to one lot he added a few of the shrimps, not so to the other. Both lots spawned, but it was only where the shrimps were that any young were produced. On examining the shrimps, he discovered the ova attached to the under surface of these crustaceans, and he felt persuaded that their maternal care is a necessity for bringing forth the fry. But Lacépède suggested that the shrimps eat the ova of flat fishes, and some may become glued to their under surface when they are unable to devour them. Comparatively rare as the male is, as already observed, I obtained one full of milt in February, 1882. Respecting how it is that in some localities the number of plaice appears to have decreased, see page 223.

As food.—This fish is in the best condition about May, and Mr. Mayhew computed that upwards of three millions are annually consumed in London. Off Devonshire, its quality depends upon the nature of the ground on which it is captured, for, if muddy or sandy, the taste partakes more or less of either. When from sand, it is firm and sweet; if from mud, the reverse. In Banffshire it is held in little estimation; it is usually deemed poor as food, but bears carriage well. In Ireland, however, Thompson states that it is held in general esteem.

Habitat.—From Iceland, along the coasts of Northern

Europe, to the British and French shores, extending in diminished numbers into the Mediterranean.

Found all round our coasts. In the Orkneys and Zetland abundant; Moray Firth, common, especially during April; has been recorded from Banff; Aberdeen; St. Andrews; Firth of Forth; Berwickshire; Yorkshire, resident, very common, but Mr. Mudd informs us that it is becoming more scarce, and that it is found in greatest numbers in or near the Dogger Bank; at Great Grimsby its diminution is causing alarm to some of the fishermen; Norfolk, common; found all along the south coast, the largest said to come from Sussex; off Mevagissey, in Cornwall, they swarm in shoals during the autumn, and Mr. Cornish observes that those from a hard, close killas sand are usually good edible fish. Those from a loose gravelly sand are valueless.

In Ireland it is abundant round the coast; to the north it is the most common species of flat fish.

Although one of these fish weighing 6 or 7 lbs. is a fine example, Donovan and others have recorded it up to 15 lbs. weight.

2. Smear-dab (*Pleuronectes microcephalus*).

Names.—Smear-dab, due to its being frequently covered with slime; *lemon-dab* or *lemon-sole* (Belfast), owing to its colours; *Mary-sole*, Scotland, Devonshire and Cornwall, in which last county it has likewise been known as *kit; smooth-dab* or *bastard-sole; town-dab*, Hastings; *French sole*, Youghal; *sole-fleuk*, Moray Firth; *sand-fleuk*, Edinburgh.

[illegible], vii., D. 85–93, V. 5–6, A. 70–76, L. 1, 130, Cæc. Vert. [illegible].

Length of head, 6¼ to 6½; height of body, 2½ to 3 in the total length. *Eyes.*—The lower slightly in advance of the upper, placed close together, and not half a diameter from the end of the snout. Jaws of equal length in front, the maxilla not reaching to beneath the front eye. *Teeth.*—Conical, rather compressed and blunted; from 11 to 13 in either jaw on the blind side. *Fins.*—Dorsal commences above the centre of the upper eye; its rays are longest in the posterior half of the body, where they equal about half the length of the head. Ventrals free. No spine before the anal fin, which latter is similar to the dorsal. Caudal rounded. *Scales.*—Cycloid covering the head (except the snout), body, and minute ones on the coloured surface of the vertical fin rays. *Lateral-line.*—On both sides; at first makes a slight curve, more pronounced in some examples than in others, the convexity of which is above, and is then continued almost direct to the centre of the base of the caudal fin. *Colours.*—Dull yellowish, blotched, and with dark spots, more especially over the chest and along the base of the anal fin. Dark blotches and spots likewise on the anal, caudal, and ventral fins. A dark base to pectoral, which has also some cloudy markings. On the under surface Pennant observed that it was sometimes marked with fine large dusky spots, but that such were not persistent.

Varieties.—Thompson took an example similar to Donovan's, March 3rd, 1835, free from spots, obscurely marked on the upper side and vertical fins with many shades of brown, gray and dull yellow, the orange stripe round the base of the operculum being very conspicuous; it and another had a lemon mark about an inch behind the base of the pectoral on the coloured side.

Habits.—In the Firth of Forth it appears during the spring, but two or three seasons pass when not half-a-dozen of these fish are seen in the Edinburgh market. In 1835 they were unusually plentiful, particularly in February, but after March they were scarcely ever met with. Having shed their spawn about April, they retire to rocky ground for the remainder of the year. They feed on shell-fish and crustacea. Thompson found a *Nereis* in one.

Means of capture.—Beam-trawl, and with small hooks.

Baits.—Soft molluscuous animals.

Breeding.—Spawns in May and June.

As food.—Thompson considered it "a much better fish than plaice, although not so good as sole nor so sweet as the dab." R. Couch says, "it is but little esteemed as food;" and Cornish, "that it is a very excellent fish."

Its body is rather thicker than the common dab, and Yarrell considered its flesh equally good, while Parnell says some people reject it because it possesses a strong, disagreeable, tarry flavour, while others believe no flat fish surpasses it in excellence, the flesh being firm and well tasted. The difference depends upon the period of the year when captured, it being good during December, January and February, and unwholesome during April, May and June.

Habitat.—From Iceland and the northern coast of Europe to the British Isles and French coast. It has likewise been captured of Kamtchatka (Steindachner).

In the Orkneys and Zetland, Dr. Duguid obtained one in August, 1848, and Mr. Iverach in July; has been recorded from the Moray Firth; Banff; Aberdeen; St. Andrews; Seton Sands and Aberlady Bay; during February, March and April, off the Fifeshire coast; Firth of Forth, not common, but mostly seen in spring months; Berwick, not common; Yorkshire, resident and common;

Norfolk; Sussex coast; Devonshire; Weymouth; Cornwall. At Plymouth it is known as "merry sole;" at Hove as "the kit;" at Penzance as "the queen" or "queen fish" (Pennant); and it is taken in South Wales; Swansea.

Ireland.—"Occasionally taken around the coast, but not in large numbers in any part of it" (Thompson) and at all seasons.

Portrush, county Antrim, "not uncommon, as several specimens may almost always be picked out of a night's trawling." Ogilby mentions an example 17 inches long.

3. Pole (*Pleuronectes cynoglossus*).

Names.—Pole or *craig-fluke*, *pole-dab*. *White sole*, county Down. *La Plie Cynoglosse*, French.

B. v., D. 102–115, V. 5–6, A. 86–100, L. 1, 115.

Length of head 6¼ to 6½; height of body 3¼ to 4 in the total length. *Eyes.*—On the right side, and separated from each other by a very narrow ridge, which is scaleless in small, minutely scaled in large examples; lower eye one-third in advance of the upper, and 2 diameters in the postorbital portion of the head. Lower jaw slightly the longer, and with a tubercle below the symphysis. Maxilla extending to beneath the front edge of the lower eye. Body very thin. *Teeth.*—In a single row, compressed, with their crowns somewhat obtuse; most developed on the blind side. *Fins.*—Dorsal commences over the centre of the upper eye, its rays undivided, the longest being at its middle; posteriorly it terminates almost close to the root of the caudal fin, which latter is wedge-shaped. Anal similar to the dorsal, but its middle rays not so elongated. A small spine, directed anteriorly, is situated in front of the base of the anal fin. *Scales.*—Cycloid on the blind side, feebly ctenoid on the coloured; some very fine ones over the fin-rays in adult examples. *Lateral-line.*—With a slightly oblique descent above the pectoral fin, from whence it proceeds direct to the centre of the base of the caudal; it has a dorsal branch on the occiput. *Colours.*—*Right side* brown, with a gray tint, being darkest about the head. A small blackish mark on the upper half of the pectoral fin. Vertical fins of a grayish slate colour, the anterior dorsal rays tipped with white. *Left side* white.

Varieties.—Thompson, when examining large numbers of this species, found in one lot the males, in another the females, almost exclusively prevailed; also that the form of the body, and the height of the dorsal and anal fins, varied considerably in both sexes.

Habits.—Frequents sandy localities, in some years being much more common than in others. Parnell found small crabs and star-fishes in the stomach of one he examined.

Means of capture.—The beam-trawl.

Breeding.—May and June.

As food.—Is considered good by some, especially the French, who esteem it to be equal to the sole. In Dublin it is looked upon as very inferior, and Thompson remarks upon having had it dressed, when he found it a passably good fish, but not at all flavoured like, nor equal to, the sole.

Habitat.—It extends from the coasts of the North Sea, around Great Britain and Ireland, to the shores of France. It is also found on the North American coast (Goode and Bean).

Mr. Pearce records an example 19¼ inches long, taken in Scalpa Bay, near Kirkwall, in May, 1880, and a day or two after another and smaller one, the only ones ever heard of in that locality; Banff, rare, but recorded from Aberdeen; Firth of Forth, occasionally obtained during April, May, and June. Along the south coast at Brixham common, but becomes very rare in Cornwall. Higgins obtained two at Weston-super-Mare, and Mr. Baker two at Stolford, in Somersetshire.

In Ireland it is found on the north-east, east, and south-west coasts. On April 26th, 1837, six examples, from 12 to 14¾ inches long, were obtained by Thompson at Belfast, and on March 25th, 1839, about 120 were brought in at one time to the market at Newcastle. They had all been captured by trawling, and about 70 more were said to have been also taken, but this was a quite exceptional take. On May 5th one was captured at Ardglass.

It attains to at least 14 inches in length on the British coast, and Thompson records one 16½ inches long, from Ireland.

4. Dab (*Pleuronectes limanda*).

Names.—Common dab. The term "dab" is considered to be one of contempt, as in Lincolnshire it refers to an insignificant fellow; *sattie*, Aberdeen (Sim); *salt-water fluke*, Edinburgh; *grey fleuk*, Moray Firth; *grey back*, Portrush, co. Antrim (Ogilby).

B. vii., D. 65–78, V. 6, A. 50–62, L. 1, 86–96, Cæc. pyl. 4, Vert. 39–40.

Length of head 4¾ to 5; height of body 2⅔ in the total length. *Eyes.*—The lower slightly anterior to the upper; diameter 5½ to 6 in the length of the head, ½ to 1 diameter from end of snout, and separated by a narrow osseous ridge. Lower jaw prominent; the maxilla, which is as long as the orbit, extends to beneath the first third of the eye. *Teeth.*—A row of about 22, closely set, lanceolate ones on the blind side. *Fins.*—The dorsal commences above the middle of the upper eye; the rays gradually increase in length to about the centre, when they commence decreasing in height. The fin does not reach the base of the caudal. Ventral not joined to anal. A small spine, directed forwards, at the commencement of the anal fin. Caudal slightly rounded. *Scales.*—On coloured side with ctenoid margins, those between the eyes and on the cheeks smaller than those on the body. A row along each dorsal and anal ray. *Lateral-line.*—Smooth. At its commencement it has a semicircular curve above the pectoral fin, while it sends a branch over the occiput. *Colours.*—Brownish, with some cloudy markings and spots; dorsal and anal fin, with whitish margins. Occasionally white or yellow spots are seen on the coloured side of the body, which appear to denote the fish being a female.

Varieties.—Thompson observed, in some examples he took at Ballyhome Bay (co. Down), in September, that they had a few black spots and markings over the body and fins; also, at the base of the dorsal fin, about six round white spots, at regular distances, and about four similar white spots regularly disposed at the base of the anal fin.

Habits.—Frequents most sandy localities around the coasts, and Parnell found it in shallow water. It feeds on marine worms and small crustacea. Thompson found in the stomach of one, captured in March at Belfast, "fragments of one of the bivalve shells, *solen* (neither of the two smaller species) and of corallines, among which *Sertularia dichotoma* was apparent." Johnston remarked that off Berwickshire its favourite food appeared to be the pretty *Pecten obsoletus*.

Means of capture.—Beam-trawl, seine (Montagu), hand-lines, and deep-sea lines, being more easily taken by hooks than any other flat fish.

Baits.—Marine sandworms and bodies of testaceous molluscs.

Breeding.—March, April, May, and June. Many as small as 1¾ inches long were received from the mouth of the Thames, in November, 1880, and some male and females, with the roe and milt fully developed, in February, 1883, from the south coast.

As food.—A high-flavoured and excellent fish (Thompson), but if waters are muddy, the taste partakes of such; it is largely eaten among the poor of London and Paris. It is in the best condition from February to April in some places, from August to December in Cornwall.

Habitat.—From the shores of Northern Europe to those of the British Isles, and extending to the coasts of France, being abundant off Brittany and Poitou, but less common in the Gulf of Gascogne.

It is found on most parts of the British coasts, being tolerably frequent in the Orkneys and Zetland; abundant at times in the Moray Firth, also pretty frequent off Banff and Aberdeen; not uncommon at St. Andrews; common in the Edinburgh market and Berwick; off Yorkshire it is resident, very abundant, and known as the *sand-dab* at Redcar. It is by no means uncommon along the south coast, especially Devonshire, and very common off Brixham and Cornwall.

In Ireland it is not rare round the coast, and has been recorded from Dublin, Waterford, Youghal, Galway coast, county Down, Belfast and Strangford Loughs, while at Portrush, county Antrim, it is the most numerous kind brought up by the trawl, rarely, however, exceeding 12 inches in length (Ogilby).

It has been recorded off the British Isles, by Parnell, up to 15 inches in length.

B. *Teeth conical.*

a. *Lateral-line with a slight curve anteriorly.*

Flounder (*Pleuronectes flesus*).

Names.—*Flounder* and *mud-flounder*, *flounder lantern*, Cornwall; *fresh-water fleuk* and *bigger fleuk*, Moray Frith; *mayock fleuk*, Edinburgh; *fleuk*, Northumberland; also *flewke* and *fluck*; *butt*, Yarmouth; *sea bague*, Isle of Man (Crellin); *black back*, Belfast Bay.

B. v., D. 60–62, V. 6, A. 39–45, L. 1, 85, Cæc. pyl. 2, Vert. 12 | 23–24.

Length of head 4; height of body 2¼ in the total length. *Eyes.*—Less than 1 diameter apart, and the lower slightly in advance of the upper. The eyes are so prominent that they are capable of observing objects on both sides of the head. Lower jaw in advance of the upper. The length of the maxilla equals about a quarter that of the head, but does not reach to beneath the eyes. *Teeth.*—Conical, blunted; two rows in the upper and one in the lower jaw. The outer row on the upper jaw of the blind side consists of 15 teeth, the corresponding row in the lower jaw of about 17. *Fins.*—Dorsal commences opposite the middle of the upper eye; its longest rays are in the posterior half of the body. Ventrals free. A strong spine, pointing forwards, exists before the base of the anal fin, which latter is similar to the dorsal. Caudal cut square. *Scales.*—Small, cycloid; rudimentary ones on the cheeks. A rounded and rough tubercle between the bases of each of the dorsal and anal rays. *Lateral-line.*—Commencing opposite the angle of the mouth, curves round the lower eye, and having joined the interorbital ridge, is continued to the centre of the base of the caudal fin. Cæcal pylori, short. *Colours.*—Vary very considerably, and depend upon that of the ground of the locality which they inhabit, but even then scarcely two will be found to be exactly similar. The colour of the upper side is generally olivaceous-brown, with or without darker blotches. Occasionally examples are even dark, when they are termed sea-flounders. The under surface is white.

Young plaice and flounders of equal size may be distinguished, prior to the appearance of tubercles along the bases of the dorsal and anal rays of the latter, by the plaice having distinct scales, whereas they are rudimentary in the flounder.

Varieties in colour.—Double examples, or such as are coloured on both sides, are not uncommon; also reversed ones. Some are partially or entirely albinos. Newman recorded an albino-flounder with red eyes. "In 1862 an albino variety was brought to me. Both sides were white, and the fins and eyes pink" (Lowe, Norfolk Fauna). In some there are orange spots, somewhat similar, but usually less vivid, than seen in the plaice. On February 22nd, 1882, I obtained a number from Brixham, all having orange spots similar to the plaice, and was informed that this is an appearance peculiar to spring-time. Thompson observes that the examples he examined thus marked were taken in March. Some are of a rosy hue, termed *Pleuronectes roseus* (Shaw), or of a flesh-red, with irregularly but distantly placed dark-coloured spots, *Platessa carnaria* (Brown). Higgins remarked on one he termed *Platessa melanogaster*, notched above the eyes, of a very dark-brown colour, almost black, on both sides. Newman continues that it is a favourite trick of the fisher-boys to cut a notch in the place indicated when they catch a flounder too small to be saleable. As the notch heals the edges recede, so the dorsal fin appears to commence further back than is normally the case. Whether this is the explanation of all such varieties may be questionable, as some are evidently due to an arrest of development, as observed in the plaice, turbot, &c. Thompson refers to the malformed head of one resembling Yarrell's brill.

Habits.—It is found round our coasts, ascending rivers to far above tidal influence, and is able to live in very impure water.

There is not much to say of its habits. Its name, *flounder*, has been asserted to be derived from the Swedish word Flundra, denoting its swimming close to the ground. Here it buries itself in the sand or soil, by working down first one side of the body and then the other, and thus its back becomes covered, while its elevated eyes and mouth remain clear, for the purpose of seeing and capturing its prey. In some rivers it is found among stones, or on the side of sandy banks in mid-stream; but muddy holes are reputed not to be the places where it usually resorts. It will wriggle itself up the sides of posts when under the water, and it retains its hold by means of its vertical fins. It is a greedy and voracious feeder, eating worms, slugs, crabs, young fish, and animal substances. Thompson found, in one he examined at Belfast, the remains of *Rissoa ulvæ;* and Johnston, off Berwickshire, obtained from them *Pecten obsoletus.*

That this fish ascends into fresh water is very certain. If we turn to Belonius, De Aquitilibus, published in 1553, we find it described as *Passer fluviatilis, vulgo flesus.* It is said by Bloch and others that this name was given owing to its colour being similar to that of a sparrow, and because it inhabited rivers. The flounder is found in the sea and at the mouths of all the larger rivers round our coasts, and is common in the North Sea and Baltic. Donovan observed that it inhabits both salt and fresh waters; Montagu that it is taken in the Avon, to within three miles of Bath; Yarrell, that it exists in the Thames, as high as Sunbury; Parnell, that it ascends rivers to a considerable distance, particularly when the waters are discoloured and increased in size by heavy rains. Personally I have a recollection of taking flounders with a worm, about thirty years since, from the Severn at Shrewsbury. Mr. Henry Shaw, of Shrewsbury, observed: "Flounders were caught, thirty-five or forty years ago, about Shrewsbury, and a long way above, in considerable numbers; but since the weirs about Worcester and Gloucester have been made, their ascent has been stopped. The Peplows (fishermen) used to lay what they termed sprigtail lines for them, in the early spring months, on the sandy places they frequented. This sprigtail consisted of a crooked pin, with a double bend, having the form of two knees; to this was affixed about four horse-hairs, and baited with part of a worm. The flounder swallowed it, and, as soon as he began to pull, the pin became crosswise. They used to employ two to three hundred at a time on a long line, and lay them at night-time." Were the weirs on the Severn destroyed, these fish would immediately remount that river, at least to as high as Shrewsbury.

Means of capture.—Lowe observes that in the shallower parts of the Loch of Stenness he has seen vast numbers taken with a seine-net. Thompson mentions having observed a fisherman at the mouth of the Bann using an implement as follows: it was in the form of two sides of a garden reel, with a spike, which was stuck into the ground;

to this about forty yards of line were attached, having a very heavy sinker at its extremity, and hooks along its whole length, which were baited with pieces of crab. By flinging out the sinker, the line became carried into the water its entire length.

In November, 1862, flounders at Gothenburg and its vicinity were so abundant, after a severe storm on the coast of Denmark, that although 2½ millions were captured, the sea literally remained full of them; 500 men were engaged day and night in this capture, and at last they were unable to salt such a number. Pontoppidan relates that when the fishermen row their boats over sandy ground where the flounders are seen in clear weather lying in heaps together, they drop a line with a heavy lead to it, under which a little lance is fixed, which, by the weight of the lead, sticks into the flounder, and it is pulled up with the line.

Baits.—The angler finds a well-scoured lobworm much approved of, but they will also take a piece of fish; the novice has to be warned not to strike too soon, as the worm is sucked in some little time prior to its being gorged, while, owing to the size of the fish's mouth, a small hook has to be employed. In some localities it is found to bite best in the early morning. It lives long after removal from its native element, being very tenacious of life. This makes its carriage and transference to distant places easy.

Breeding.—It spawns from February to about April, or even later. Harmer recorded finding 1,357,400 eggs in one 24¼ oz. in weight; 351,026 in a second of 6¾ oz.; 225,568 in a third of 3½ oz.; and 133,407 in a fourth of 2¼ oz.

Life history.—The development of the eyes of these fishes, and the changes the young undergo, has been referred to.

Diseases.—Lowe mentions having frequently seen specimens from the Ouse "affected with a peculiar skin disease resembling epithelioma—large fungous growths cropping out over the whole body—the granulations large and roe-like—under the microscope consisting of large nucleated cells."

Uses.—In Norfolk it is fished for in order to be used as a bait for the lobster fishery, while it is largely eaten by the cormorant and other birds.

As food.—It is watery, poor meat, and inferior to the plaice, both as to flavour and size; but authors are not agreed as to whether the marine or river forms are the best for the table, while it has been stated to be equally good from both localities, the flavour depending on the food it has been living on. It is considered nutritive and easy of digestion. Lacépède observes that its flesh is softest in the fresh-water examples, due to their more rapid growth. In this country such as come from the Thames are generally deemed firmest, and superior to those from any other river. Memel, in the Baltic, has long been celebrated for its flounders. The Frieslanders esteem this fish so much that they naturalize it in fish-ponds. Thompson observes that it is not much esteemed at Belfast. Lowe considered that if fried it is delicate eating.

Habitat.—From the coasts of Northern Europe to those of the British Isles, while off France it is common in the Channel and along Brittany, Poitou, the Gulf of Gascogne and Arachon (Moreau).

It is abundant around the British coast, and is especially partial to the mouths of large muddy creeks; when not impeded by artificial or natural obstructions it ascends rivers long distances. It inhabits all the bays and creeks of the Orkneys, especially if the ground is flat and sandy;

abundant in the Moray Firth, ascending the Lossie nearly as high as Elgin (Gordon); is pretty frequent off Banff (Edward); Aberdeen (Sim); abundant at St. Andrews (McIntosh); during July and August captured in large numbers in the Firth of Forth in the salmon nets, particularly above Queensferry, as well as in Leith Harbour with the hook (Parnell); Berwick, common (Yarrell); resident in Yorkshire along the coast and rivers, in which its ascent is mostly stopped by weirs; every year in the Ribble from May to September; common in the Norfolk estuary; down the east and along the south coast and Bristol Channel.

Common round the coasts of Ireland (Thompson).

It attains to about 8 or 9 inches in length, and 4 lb. weight. Donovan recorded one 4½ lb., and Pennant another of 6 lb.

GENUS 7.—Soles (*Solea (Klein) Cuvier*).

Geographical distribution.—All temperate as well as tropical seas, except the southern portion of the south temperate zone, and though normally marine and littoral forms, still some enter fresh waters in which they have been acclimatised and thriven. On retaining some in fresh and others of a like weight in saline water, the first at the end of a year were found to have increased at twice the rapidity of those which were kept in salt water.

Among the flat fishes annually captured around the British coast, none exceed the sole in value as food, while they are esteemed both by rich and poor. Their value is often enhanced by the locality they come from; thus Torbay, Folkestone, and other places are more or less famed for the quality of the fish which are taken from their waters.

A most important subject, and one which deserves a more searching investigation than it has yet received, is whether the fish are decreasing in quantity around our coasts, and, if so, the reason? To illustrate one side of this question, I give an extract from a letter from an east coast fisherman, which speaks for itself: "It is well known among fishermen that there is a falling off in the supply of plaice and soles to an alarming extent, whatever may have been said to the contrary by smack-owners and fish salesmen. To explain this, I shall have to carry you back to the time when we first went to fish off the Sylt, about ten years ago, at which time very nearly all the ground from Horn Reef to Heligoland was covered, as it were, with shoals of small plaice, and intermixed with these plaice were a good many soles, both large and small. We have got as many as eighty baskets of small plaice and ten baskets of soles for one night when we first went there, and very nearly all the plaice would be thrown overboard, and you may be aware that they always die after they have been hove on board a trawler. These fish are so small that I have counted two hundred and fifty in one basket, such as we use at Grimsby. The small plaice that are brought to London market are the largest picked out, the others are thrown away. Now, we have fished there every summer, having big bags of small plaice on board, and throwing them away for the sake of the soles, till by destroying the young brood, full-grown plaice have grown very scarce. At the present time very small plaice will sell well, so that now the soles have grown scarce off the Sylt, the small plaice, being saleable, make up, so they are bound to be caught unless stringent measures are taken for their preservation. You must remember that the quantity has decreased during these last few years, twenty baskets being the most you would get for a night now. My opinion of the matter is this, that as the ground from Horn Reef to Langeroog, within a less depth than twelve fathoms, is a natural nursery for the young brood, if the wanton destruction of it continues as it has done, we shall soon find it extremely difficult to find even a moderate supply of full-grown plaice, and I have no doubt that soles would be more plentiful too were some protection afforded. It is to the interest and benefit of every one in the fish trade that no English trawler should be permitted to fish within the above depth."

Mr. Mann, writing from Bournemouth to the *Field*, in April, 1882, observed: "I have just weighed a sole of one ounce, and a turbot of four ounces, which were exposed for sale here. They were selected from many others of like size. Sixteen pounds weight were captured on one occasion, the largest not exceeding eight ounces. The bulk were taken in long-shore nets, known as 'tucks,' of small mesh, from which nothing can escape; but this form of net does not kill the fish, which ought to be at once returned to its native element." Small turbots and soles are often placed in the bottom of the pads and boxes sent to the London markets, but the bulk of them are sold in the towns and villages along the sea coast.

It has again and again been brought prominently to notice, especially about the northern grounds of the North Sea, that the supply of soles taken in British waters is yearly decreasing, as evidenced by the trawlers having to go further out to sea, that an increased number of vessels capture only an amount similar to what formerly were obtained by fewer boats manned with less hands, and likewise that the fish supplied to the markets consists of such as are much smaller than used to be the case. Mr. E. Jex, of Billingsgate, remarked (January 7th, 1882), "There have been during the past year some thousands of boxes of soles in this market from Yarmouth, Lowestoft, and Ramsgate, while not more than one-fourth of the contents of each box consisted of fish that ought to have been caught—three-fourths of each box containing nothing but slips and tongues."

At Weston-super-Mare in 1879 some new trawling ground was tried, and the large size and quantity of these fishes that were taken amply recompensed the trawlers. But such localities are often over-fished, and soon become exhausted, and thus quantity has to be made up by those of a smaller size. This is possibly what is found to occur in most places. Thus, Mr. Dunn observes that his father was the first fisherman who employed a beam-trawl in Mevagissey Bay; he captured enormous numbers of fish, so much so that he kept a record, which has, unfortunately, been lost. When the Plymouth trawlers first commenced their operations in new localities off the south-west coast (which was about the time the Californian gold-fields were discovered), they termed their new grounds "California," as illustrating the amount and value of their captures.

It has been pointed out by Mr. Epton and others, that a large fleet of smacks towing over the same ground will in a short time clear off the fish which are there. But the main cause of the diminution in the North Sea is generally asserted to be due to the numbers of undersized fish which are wantonly destroyed in shallow water, or their natural brood-grounds, by trawling smacks, steam trawlers, and shrimp catchers, more especially by smacks along the German coast during the spring and summer months.

But while it has been proposed to legislate for this state of affairs by prohibiting the exposure for sale of soles under 6 inches (7 inches, Buckland) in length a difficulty arises which would first have to be investigated. Thus at certain seasons the "thick-backed sole," *Solea variegata*, which rarely exceeds 6¼ inches in length, is common in the Plymouth markets, and perhaps finds its way to London; while the "little sole," *Solea lutea*, abounds along the south-west coast, and is generally thrown overboard as useless, or sold as manure. Any prohibition against the capture of soles under a certain size would cause taking these forms to be penal. This opens up the question—what, if these small forms alone are permitted to increase off the south-west coast will be the effect on the food of the *Pleuronectidæ* in general? For should the useless forms be protected, and if they live on the same diet as the useful table sole, it appears as if such legislation might cause more injury than benefit to the fisheries.

1. Common Sole (*Solea vulgaris*).

Names.—*Sole*, as the Greeks considered it would form a fit sandal for an ocean nymph; *slips*, or *tongues*, the market terms for the young; also *tongue-soles* in the Moray Firth, and *leesters* in Suffolk.

B. vii., D. 73–86, V. 5–6, A. 61–73, L. l. 160, Vert. 9 | 39–40.

Length of head 5½ to 5¾; height of body 3¼ to 3½ in the total length. *Eyes.*—The upper slightly in advance of the lower; interorbital space exceeding 1 diameter of the eye in width. Jaws of about the same length in front. Cleft of the mouth extends to beneath the middle of the lower eye. Some short filaments on the snout and on the blind side of the head. Nostrils on coloured side just in front of lower eye, the posterior one patent with a thick lip on the upper side; the anterior one tubular. On the blind side the anterior nostril is above the centre of the upper lip, and scarcely tubular; the posterior nostril is as far behind the anterior as the latter is from the end of the snout, it is patent with slightly elevated edges. *Teeth.*—Small, but distinct on the blind side. *Fins.*—The dorsal commences in front of the upper eye. Ventrals free. Caudal rounded. *Scales.*—Ctenoid, and continued on to the fin-rays. *Lateral-line.*—Straight. *Colours.*—Brown or gray on the coloured side, frequently blotched with black. Vertical fins with a narrow white outer edge. Pectoral usually with a black blotch in its outer half, which is very distinct in the young. "The colour of the sole depends upon and varies according to the quality and depth of the feeding ground; (at Weymouth) there are four prevailing varieties: (1) a dark sole; (2) a shrub sole, from the markings on the back having the appearance of shrubs; (3) a lemon sole; and (4) a spotted sole. No. 1 is, I believe, caught in the shallowest water; No. 2 next; and Nos. 3 and 4 in the deepest water" (W. Thompson, Zool. 1851, p. 3375).

Varieties.—M. Capello states that examples from the coasts of Portugal vary in the number of their fin rays from D. 85–95, A. 74–78 (Journ. Sc. Matt. phys., e. nat. Lisbon, no. ii., 1867, p. 164). Near the mouth of the Ouse a variety is taken termed *cardine;* its head is large and elongated, but its flesh is rather coarse. Reversed examples are not rare, neither are double ones or such as are coloured on both sides. There are also semi-albino or piebald specimens.

Thompson observes that those from the north of Ireland vary considerably in form and colour, some being narrower than others, and tapering more towards the tail. An example 12 inches long from Brixham has the caudal fin lost, and a new one formed continuous with the dorsal and anal.

Habits.—Appears to prefer sandy or gravelly shores, and is retentive of life, but rather uncertain in its migrations, for although mostly appearing at certain spots almost at a given time, and usually decreasing in numbers by degrees, in other seasons they disappear at once as suddenly as they arrived. "The finest soles have been taken," observes Andrews, "in the Arun River, miles above the tideway, and where they breed and remain throughout the year." "In the estuary of the Humber," observes Mr. Eagle Clarke, "they are captured from May until August inclusive; all are either in spawn or shotten. The young are very numerous in the shallow water at the edge of the tides." Yarrell, on the authority of a correspondent, remarks that they breed in the River Arun, frequenting it from the mouth five miles upwards, which is nearly to the town of Arundel, and remain in it the whole year, burying themselves in the sand during the cold months. It is not unusual for them to ascend rivers to some distance, while they will live and thrive in fresh water. Along our sea-coasts they retire to the deep as frosts set in, revisiting the shallows about May if the weather is warm, their migrations being influenced by temperature. Although very large examples are occasionally taken in Lynn Deeps, this fish, similar to the whiting, only attains about two-thirds the size off Norfolk and Suffolk, that it does off Devonshire.

In Ireland Dr. Farran in October found *Cardium elongatum* abundantly in their stomachs, a few *Bulla aperta*, and a number of *Echinocyamus pusillus.* (November) *Amphidesma Boysii*, a *Dentalium*, and a few *Amphidesma prismatica.* (December) *Amphidesma prismatica*, a *Lysteri*, an *Anomia*, and *Donax trunculus.* The sole has been reputed to eat the eggs and fry of other fishes and sea-urchins, &c.

Means of capture.—Generally the trawl. The principal

English trawling ground lies from Dover to Devonshire. They may be taken by spillers, but are not commonly captured with hooks; it is suggested that one reason may be that spillers are mostly used by day, whereas the sole is a night feeder. In-shore trawling, shrimping, and fine-meshed netting during the spring months occasion great injury to the young of these fishes, as do also hose-nets set for shrimps. Mr. Welton, of Bridgewater, purchased all the fish taken in two of these nets in one day, and thus obtained 18 cwt. of the fry of soles, plaice, herrings, whiting, &c.

Baits.—Major Holland advises soft or soldier-crabs, lugworm, mussel, shrimp and rag-worm, with long-gut snoods, but they feed mostly at night, and the most favourable time is after a blow, when the water is thick, while a land breeze answers better than a sea breeze.

Breeding.—They spawn late in the year and during the spring months. I have obtained them in full roe this year up to April 15th. A sole of 1 lb. weight carries about 134,000 eggs (Buckland).

Hermaphrodites.—Have been recorded by Yarrell.

Life history.—The very young swim on edge, as has been already referred to, but they do not appear to be commonly found so far out at sea as some other species. They are first seen along our south coast about the end of March or commencement of April.

Diseases.—Buckland mentions having received a sole in which its entire lower surface was studded with hairs from ⅛ to ½ an inch in length. On a microscopic examination being made they turned out to be the hairs of the sea mouse, *Aphrodite aculeata.*

Uses.—The skin of the sole was much used, according to Parnell, for fining coffee, being found a good substitute for isinglass; also as a material for artificial baits.

As food.—The flesh of this fish is white, firm, and of excellent flavour, those from the deepest waters being generally preferred; during the time of breeding, and for a short period subsequently, they are soft and watery. Those on the west coast and to the south are larger as a rule than those towards the north of these islands. Mayhew tells us that London requires annually 97,520 soles, while that market is principally supplied from the Norfolk coast and the English Channel.

Habitat.—It extends from the seas of Scandinavia and the Baltic southwards, round all the coasts of France, and is found in the Mediterranean.

It is taken in the Orkneys and Zetland, but is rare; it is not very common off Banff, but found off Aberdeen; is common in the Moray Firth, but not much sought after; frequent at St. Andrews; sparingly at the mouth of the Firth of Forth. Resident and common off Yorkshire. Has once occurred at Goole, in the estuary of the Humber, near the mouth of the Ouse; the Great Grimsby fishermen assert that they capture most of their small soles off the Dutch coast. Common in the Norfolk estuary; abundant off the south coast from Sussex to Devonshire, and common off Cornwall. Also found in the British Channel, and generally around Great Britain.

In Ireland soles occur all round the coast, and Thompson remarks that those in the north vary considerably in form and colour from those more to the south. As to the size it attains, Thompson's largest example was 20 inches in length. Mr. Grove, of Charing Cross, received one from Torbay on February 1st, 1882, 24 inches long, and which weighed 6½ lb. A correspondent of the *Field* alludes to one weighing 7½ lb. captured at Bridgewater, on June 4th, 1881; and casts of a pair from Ireland, which weighed together 12 lb., are in the Buckland Museum. Yarrell mentions one 26 inches long and very thick, the largest he had ever heard of, which was brought to the Totnes market, and weighed 9 lb.

B. *One of the nostrils on the blind side dilated and fringed.*

Lemon Sole *(Solea lascaris).*

Names.—The *lemon sole* from its colour ; *sand sole* from the localities it frequents ; *French sole* ; *Borhame,* Northumberland.

B. vii., D. 82–88, V. 5, A. 67–71, L. l, 130–140, Vert. 46.

Length of head 5⅓ to 6½ ; height of body 2⅔ to 2¾ in the total length. *Eyes.*—The superior half in advance of the inferior ; about 1½ diameters from the end of the snout, and about 1 diameter apart. This species is rather thicker than the common sole. Upper jaw slightly longer than the lower, but not produced into a lobe. The cleft of the mouth extends to beneath the middle of the lower eye. Some filaments on the snout, very numerous on the blind side of the head, and also on the few first dorsal rays. Nostrils on the coloured side tubular, the anterior one being the longer. One of the nostrils on the blind side is nearly circular, very wide, and encircled by short and branched filaments. *Teeth.*—Distinct on the blind side. *Fins.*—The dorsal commences in front of the upper eye ; most of the fin rays branched. The two pectoral fins are equally long, and 2½ in the length of the head. *Scales.*—Ctenoid, continued on to the fin rays. *Colours.*—Of an orange or lemon yellow marbled with darker and covered with numerous small black blotches and dots, among which are some light or even white ones. Pectoral fin with a large black blotch, surmounted by a light ring in its posterior half. Vertical fins of the same colour as the body. In some examples the yellow colour is entirely lost after they have been a few weeks in alcohol, leaving the fish grey, marbled with darker.

Habits.—Frequents sandy bottoms, and appears to be captured throughout the year.

Means of capture.—Usually by the trawl; it has been thought by some authors that it prefers deeper water than the common sole.

As food.—It is not in request for the table, being tasteless and wanting in firmness, but is occasionally slipped in amongst such as have been prepared for filleting at the fishmongers.

Habitat.—From the shores of Great Britain and Ireland, through the Mediterranean, and is found off Nice and Naples. Rare in Banffshire; found in Northumberland; resident and not uncommon in Yorkshire; found off Sussex. Occasional in Devonshire; rare in Cornwall; off Somersetshire; occasionally taken in the weirs at Swansea.

In Ireland numerous examples were captured from one place off Galway in 1848.

It attains to 14 inches in length (Buckland).

B. *Pectoral fins on both sides very small.*

The Thickback (*Solea variegata*).

Names.—*Thickback*, Devonshire, so termed owing to its being thicker than the common sole; *bastard sole*, Weymouth. It was first observed from our coast by Donovan, in April, 1807, when it was brought to Billingsgate Market.

B. vii., D. 65–74, V. 5, A. 55–58, L. l, 85–90, Vert. $\frac{10}{30}$.

Length of head 5¼ to 5⅓; height of body 3¼ to 3⅓ in the total length. *Eyes.*—On the right side, scarcely 1 diameter apart, and $1\frac{1}{8}$ diameters from the end of the snout. The upper eye one-half in advance of the lower. *Teeth.*—Very minute. *Fins.*—Dorsal commences above the front edge of the upper eye, and nearly reaches the base of the caudal fin; its rays are branched, and the highest are opposite the middle of the length of the body. Right pectoral fin very short, not equalling the length of the orbit; left pectoral still more minute. Ventral not attached to anal, which latter fin terminates similarly to the dorsal. Caudal somewhat rounded at its extremity. *Scales.*—Ctenoid extending on to the fin rays. *Lateral-line.*—Nearly straight. Free portion of the tail about three times as high as long. *Colours.*—Of a rich chestnut brown, with six or seven vertical dark bands, which are a little more than one-third the width of the interspace between each. These bands become broken up with advancing age, but may even be seen in large specimens mostly as dark marks at the bases of and passing on to the dorsal and anal fins. Caudal with a dark band in its last third, having a light outer edge. Dorsal and anal fins usually edged with white.

Habits.—On the south coast of Great Britain it appears in the spring and continues through most of the year.

Means of capture.—Trawling, and is often taken in very great numbers along the south coast.

As food.—Largely consumed in Devonshire and Cornwall, where it is held in great estimation.

Habitat.— From the British coasts to France and the Mediterranean, and common off Italy; frequent along the coasts of France, and extends into the Mediterranean. Met with occasionally off Banff, off Rothsay and the Isle of Bute in Scotland. During August, 1881, they were being landed in thousands at Plymouth from the trawlers and sold as "thickbacks;" they had been captured during at least the three previous months.

In Ireland one was dredged at Belfast, June 16th, 1838, by Mr. Drummond, and in Ventry Harbour it is not uncommon.

It attains to 9 inches in length according to Buckland.

Solenette (*Solea lutea*).

Names.—Little sole; red sole.

B. vii. D. 65–72. V. 5. A. 50–56. L. l. 72.

Length of head 4½ to 4⅘; height of body 3¼ in the total length. *Eyes.*—On the right side, rather close together, the upper being one-third in advance of the lower. Cleft of mouth extends to beneath the middle of the lower eye. *Teeth.*—Pointed and minute. *Fins.*—Dorsal commences on the snout before the upper eye and ceases close to the base of the caudal fin, its rays are branched, and the highest are opposite the middle of the length of the body. Right pectoral very short, its upper ray twice as long as the others, left pectoral still more minute. Caudal somewhat rounded at its extremity. *Scales.*—Ctenoid, extended on to the fin rays. *Lateral-line.*—Nearly straight. *Colours.*—Right side of a stone gray covered with numerous small brown or dark spots, also three or four rows of moderately sized dark blotches placed very wide asunder, but sometimes entirely wanting. Dorsal and anal fins colourless, but every here and there a ray (from the fourth to the seventh) quite black, portions of others also dark, and some dark spots along the bases of these fins. Caudal spotted. Pectoral with a black blotch in its centre.

Habits.—Appear to resemble those of the "variegated

Means of capture.—Trawling.

Uses.—Sometimes taken in large numbers in the trawl-nets; but as they are of no use for the market they are thrown again into the sea; they are likewise taken by shrimpers.

Habitat.—From the shores of Great Britain and Ireland to those of France and through the Mediterranean. Off Banffshire it is more common than the "lemon sole;" also common at St. Andrews. Reputed to have been taken at Whitby; common at Weymouth, and Mr. Cornish records capturing a star-fish in August, holding one of these fishes, 3 inches in length, in its feelers. An example was captured in November, 1880, ten miles at sea off Mevagissey.

In Ireland it is taken on the north-east, east, south, and west coasts. Ball obtained it in Dublin; McCoy observed that he found it tolerably abundant in the bay between the lightship and the harbour. McCalla took it in county Down, and Thompson mentions three dredged off Dundrum in the same county.

The largest specimen I have obtained is 4½ inches in length, but it is said to reach to 5 inches.

ORDER III.—PHYSOSTOMI.

FAMILY I.—*Scombresocidæ.*

Among the fishes belonging to this family some are oviparous, others viviparous. The eggs of many have filaments springing from their outer covering, and which enable numerous ova to adhere together in a mass, or attach themselves to contiguous objects, preventing their subsiding into the mud. It has been suggested that they are thus suspended so that by the ebb and flow of the tide they may be constantly bathed by different water. Professor Hœckel observed these filaments present in the eggs of gar-fish, *Belone;* saury, *Scombresox;* half-beak, *Hemiramphus,* and flying-fishes, *Exocœtus;* while Ryder has remarked on having found similar filaments in one form of *Atherinidæ,* the *Chirostoma notata,* but in such they are only four in number, and situated close together.

Geographical distribution.—Temperate and tropical seas; some species resident in fresh waters.

1. Gar-pike (*Belone vulgaris*).

Names.—*Sword-fish, green-ben* or *green-bane,* Scotland; *green-bone* or *green-back, guard-fish, gar-pike, horn-fish, needle-fish* or *long-nose, gore-bill, sea-needle, mackerel-guide,* which name it has received due to its coming towards shore a little prior to the appearance of the mackerel. *Gerrick,* Cornwall. *Horn-kecke* (Palsgrave). *Whaup-fish.* In Ireland, *horn-eel* (Belfast Bay); *mackerel-scout* (Strangford Lough); *spearling* (Portrush); *Spanish-mackerel,* according to Nimmo, at Roundstone. Its snout is termed *gore-bone* in some places.

B. xii., D. 18–20, V. 6, A. 22-23, Vert $\frac{52}{28}$.

Length of head 3½ to 4; of caudal fin 7½; height of body, 15 to 16 in the total length. *Eyes.*—Large, 2¼ to 2⅓ diameters in the postorbital portion of the head, 6½ to 7 diameters from the end of the upper jaw, and 1¼ diameters apart. Maxillaries concealed by the preorbital. Upper jaw not so long as the lower, which latter has a soft termination. *Teeth.*—Small, in some examples a small oval patch is present on the vomer, in others it is absent. *Fins.*—The anterior dorsal rays are elevated, forming a lobe, while the posterior ones are of about the same length and terminating opposite the anal ones, which is some distance from the base of the caudal fin. Ventral situated nearly midway between the opercle and the base of the caudal fin. Caudal forked, lower lobe the longer. *Colours.*—Of a sea-green or bluish-green along the back, becoming of a changeable blue and purple along the sides, and into silvery white beneath.

Fleming ('Brit. Anim.' 1828, p. 184) observes upon *Esox Brasiliensis* (Couch) being the young of this species: while many authors seem to have been doubtful whether the various European *Hemiramphi* were not in reality the young of *Belone.*

The Young.—Couch's magnified figure of the blunt-headed half-beak, the specimen having been half an inch in length, shows the fish in the earlier stage, when the lower jaw is commencing to increase in length; while his European half-beak, at a little over 3½ inches in length, demonstrates the fish with the lower jaw having increased, but the upper jaw still almost stationary. In Lütken's 'Spolia Atlantica,' p. 567, will be found a complete series of illustrations, showing the various stages of evolution of the jaws as they become developed with age.

Steindachner (Sitz. Ak. Wiss. Wien, 1868, lvii., p. 732) remarked upon the identity of *Belone acus,* Risso, with *B. vulgaris,* the distinction between the two forms resting principally upon the latter possessing a small ovoid patch of vomerine teeth, which is said to be absent in the latter It is remarkable that the finest example in the British Museum from the British shores is destitute of this patch of teeth, although it is present in others. Canestrini, l.c., observed upon finding vomerine teeth in an Adriatic example.

Habits.—Gregarious, migratory, and very voracious, frequently approaching the shore in large assemblages, and

though stragglers may be taken all the year round, it appears to arrive in shoals about March or April, and retires to deeper water late in the autumn, being absent throughout the winter and spring. In the *Northern Herald* (Inverness, November 22nd, 1844) it was observed that within the last three weeks this fish had been abundant; its visits are not periodical, either as regards seasons or cycles; in fact, twenty-two years had passed since they came in considerable numbers; about sixty years since there were large shoals, and they were known as *Gobbaicke ardnascar*, or "snipe-fish." Although as observed, the gar-fish is usually gregarious, Thompson remarked that in Belfast Bay it is generally found singly. Mr. Cornish (Zool. 1865, p. 9814) well describes the appearance of a shoal of these fishes when chased by the tunny, how they scudded rapidly over the face of the sea as though they were actually swimming on the surface, having the larger portion of their bodies in the air. When in pursuit of shoals of small fish it appears to be springing over the waves after them. It jumps over floating substances sometimes in a peculiar way, shooting itself bolt upright and alighting in the water tail first. Mr. Couch recorded how, in 1865, he found the upper jaw of a gar-fish transfixed through the body of a mackerel. Mr. Dunn observed upon another having similarly gone through the body of a pilchard; he also informed us, July 25th, 1881, that he had obtained that morning a mackerel with the jaw of a gar-fish transfixing the body just under the pectoral fin, where it had broken off. The same accurate observer remarked that he has reason to believe that they used their beaks as a ram against their prey, sometimes transfixing their eyes. Should they do this, of course both would be penetrated. S. Clogg
ool., June, 1874, p. 4160) observes upon a salmon-peal

having been attacked by a gar-fish. It had run its under-jaw completely through the peal, and it must have been broken off either by the force of the blow or by the struggles of each fish to free itself. The peal, which weighed nearly 4 lb., was struck behind and quite above the pectoral fin, the jaw of the gar-fish thus passing through the thickest part of the peal. Couch observed that it is an indiscriminate feeder, eating any animal substances it can seize. Thompson mentions a 15-spined stickleback having been found in the stomach of one captured August 10th, 1850. Its digestion appears to be very rapid.

Means of capture.—It will take a bait, but when hooked makes most vigorous efforts at escaping. On the coast of Donegal nets are fixed on wooden frames, and allowed to float about; those fish jumping over the sides become captured. They are frequently taken in herring nets, and during the last half of the year numbers are captured in Cornwall in the pilchard drift-nets.

Baits.—Pieces of fish, mussels, &c. It never plays round a bait, but seizes it as if it were living. It strikes obliquely upwards, hence it happens that when it takes the hook, the first notice of the capture is the fish starting into the air with the line, and then beating itself about on the surface to get rid of the hook, and in doing this it always emits a very strong and peculiar odour (R. Couch, Zool. 1847, p. 1613).

Breeding.—Along the south coast of England this fish breeds in May and June, but, according to Andrews, in July in Dingle and Ventry Bays in Ireland. The ova, owing to their peculiar appendages, are enabled to attach themselves to any object in the vicinity. These eggs when extruded must float in the sea with their long filaments waving about until they meet with some object to which they can attach themselves; or they may serve to bind together large numbers of eggs into one mass, and fix such to some suitable substance.

I have already alluded to the peculiar manner in which the jaws of this fish are developed. Under 1 inch the upper profile of the snout is somewhat obtuse, the upper jaw very short, the lower a little longer. This stage has been termed *Hemiramphus obtusus* (R. Couch), although the fishermen assured him they were the young of the gar. As the fish becomes from 2 to 3 inches in length, the lower jaw has much increased, being many times longer than the upper jaw, which is almost triangular; at this stage it has been termed *Hemiramphus Europeus.* On October 28th, 1880, I obtained an example 8·6 inches long, from Devonshire; the entire length of its head was 3·1 inches; of the lower jaw from the angle of the mouth 2·1 inches; of the upper jaw from the angle of the mouth 1·6 inches. On November 23rd, 1881, I obtained another from Devonshire, 8·5 inches long; its head being 2·8 inches, lower jaw 1·8, upper jaw 1 inch. The foregoing would lead one to conclude that this fish increases rather rapidly in length, attaining to about 8 inches in length at three months' age. The very young, Lowe found in Norfolk (July 6th, 1868), had been living upon Entomostraca.

As food.—Good eating, but, owing to the green colour of the bones of this fish, both before and after boiling, a prejudice against eating it is entertained in some localities. They are often plentiful in the London market, especially in the spring. Large numbers used to be sent there from the coasts of Kent and Sussex. Their smell when first captured is not always agreeable. Parnell states that many persons consider them superior to mackerel as food, being firmer, whiter in the flesh, and possessing much the same flavour, but it is generally considered more dry.

Uses.—Bait for ground fish when other descriptions run short, for which when cut into strips they are found very efficient.

Habitat.—Distributed from Iceland and the Scandinavian coast, the Baltic, North Sea, and Atlantic coasts of Europe to the Mediterranean.

In the Orkneys and Zetland it is not uncommon, and extends in more or less abundance during certain seasons around the British coasts. Banff, not scarce at certain seasons; found in the Moray Firth; at St. Andrews is occasionally thrown on the sands after storms. It enters the Firth of Forth in large shoals about the beginning of July in company with the mackerel, and remains till the end of August, but seldom ascends to any distance. Is taken with net and hook, and sometimes found on the haddock lines which have been baited with mussel. Berwickshire, occasional; Yorkshire, resident off the coast and not uncommon, approaching the shore in summer; in autumn it has been cast ashore in considerable numbers during heavy gales; Norfolk, off which coast it breeds, one is recorded by Lubbock as having been taken within five miles of Norwich. Along the whole of the south coast. Kent and Sussex, very abundant. Devonshire, not uncommon. Cornwall, common. Off Swansea it is not infrequent in the bay, but never in shoals, and usually of a smaller size than on the other coasts. In the Firth of Clyde, May 25th, 1877, the capture of an example 28 inches in length was recorded as a rarity.

In Ireland it is taken all round the coast, generally in the latter part of the summer and autumn; a few are also obtained in the early months of the year (Thompson). In some seasons it is common from Cork to Londonderry.

The largest British example recorded is one 3 feet long.

The Saury (*Scombresox saurus*).

Names.—Skipper, saury, saury-pike, skip-jack, skopster, halion. In Scotland, *gowdnook, gosnick, Egyptian herring.*

B. xiii., D. 10–12 + v.–vi., V. 6, A. 12–13 + vi.–vii.

Length of head 3⅓ to 3¼; of caudal fin, 9¼; height of body 10½ in the total length. *Eyes.*—2½ to 2¾ diameters in the postorbital length of the head, 4½ diameters from the end of the upper jaw, and 1 diameter apart. Jaws in the adult curved slightly and gradually upwards, the upper being a little the shorter. Posterior extremity of the maxilla not covered by the preorbital. *Teeth.*—Fine ones in the jaws; none on the vomer, palatines, or tongue. *Fins.*—The dorsal commences slightly behind the beginning of the last third of the total length, its anterior rays rather higher than half that of the body below it, the finlets continued almost to the base of the caudal fin. Ventrals inserted midway between the angle of the mouth or the front edge of the eye and the posterior end of the caudal fin, the latter being deeply forked. *Scales.*—A somewhat keel-like edge commences on either side of the fish on a level with the lower edge of the gill-covers, and passes along the entire length of the body. Scale-like appendages over the middle of the base of the caudal fin. *Colours.*—Back of a deep rich blue, below which is a broad burnished and shining silvery band, having a dark lower edge, abdomen silvery, upper fins dark coloured, lower ones and pectoral yellowish.

Much the same evolution of the jaws obtains in this fish as described in the gar-pike.

Varieties.—Valenciennes separates the Mediterranean from the oceanic form, under the belief that the former has no air-bladder. Professor Lütken (*Spolia Atlantica*) has shown, however, that this organ may be present in the

Mediterranean forms. Moreau observes that it may be absent. As no other differences exist except this inconstant one, I have not considered such to denote distinct species.

Habits.—Gregarious, migratory, in the summer being mostly at or near the surface, but during the autumn frequenting deeper water. It is usually found further out to sea than the gar-fish, while it has an extensive range. Instances are on record in which it has ascended as high as fresh-water. It first appears off Cornwall about the latter half of June or commencement of July, and in the autumn frequently shows itself in enormous schools, while it leaves the coast prior to the end of November. It is constantly in motion, moving with great rapidity, frequently springing out of the water by scores at a time, and giving much the appearance of a shoal of flying fishes. It has been frequently known to spring out of the water into the fishermen's boats, especially during stormy weather. Mr. Dunn considers the skippers and pilchards as natural enemies, and Couch held the same views. In the year 1825 skippers and pilchards were enclosed in pilchard seines together, and before they could be taken into the boat, thousands of the pilchards had their eyes knocked out by the skippers, and scores of pilchards were transfixed through the body by the beak of the skipper. The fishermen were first made aware of these fishes being on the coast by the noise they were making in the night—the one attacking, the other running away. This battle continued more or less along the coast each summer from 1825 to 1834. The fishermen consider the presence of skippers is an hindrance to the successful taking of the pilchards. Entomostraca, small crustacea, and sea-weed have been found in its stomach.

Means of capture.—In Cornwall they are frequently, in

June and July, taken in numbers in drift-nets a few leagues from the shore. R. Couch observed that he had seen 8000 enclosed in one pilchard seine-net. The largest catch of these fishes at Mevagissey, where they are annual visitors, has been 100,000 (Dunn). It has been taken with a bait.

Breeding.—The eggs of the *Scombresox saurus* are furnished externally with filaments as in the gar-fish, while the life-history of the two is also very similar, but the young of the skipper appear to be found further out to sea, and the base of the maxilla is more concealed by the preorbital. Lütken (*Spolia Atlantica*), p. 567, has figured the heads of this species from a very early age up to that of the full-grown, showing how the jaws are gradually evolved, the disproportion between the length of the two being much less than occurs in *Belone.*

As food.—Said to be fair eating.

Habitat.—Atlantic coasts of Europe, Africa, and North America; also the Mediterranean.

Lowe observed that last year (1775) such a glut of these fish set into the head of Kerston Bay, that they could be taken in pailsful; numbers were caught, and heaps flung ashore. They were from 9 to 12 inches long, and had not been observed there previously. Lowe considered they had been driven out of their course. As a rule in the Orkneys and Zetland it is rare; also at Banff and Aberdeen; St. Andrews, not uncommon; while it enters the Firth of Forth almost every autumn in considerable shoals, and, being stupid, inactive fishes, are found in hundreds on the shallows when the tide retires, with their long noses imbedded in the mud (Pennant). The same author records great numbers having been thrown ashore on the Leith sands near Edinburgh, after a great storm in November, 1768. In Yorkshire occasionally taken in harbours and shallow waters. An example about 15 inches long was taken off Norfolk in October, 1843; off Devonshire it occasionally appears in large numbers, and is not uncommon, but often abundant, off Cornwall. Mr. Cornish (Zool. p. 1463) observes upon one having been pumped up on board a fishing-boat in September, 1868. The same author remarks upon its being well known off Welsh ports. At Swansea Dillwyn never heard of it except on Turton's authority.

In Ireland Templeton observed that it is seldom found on the coast, and that he was never able to procure a specimen until one was caught near Long Bridge, Belfast, in 1820. Thompson received one 12¼ inches long from Belfast, stranded after a gale on September 17th, 1840; a second was also taken, and a third on October 7th. Sampson includes it among the fish of Derry. Ogilby observes that it is decidedly rare on the north coast. He obtained one example, cast ashore at Portrush, county of Antrim, during the last week in September, 1875; while but few years pass without some examples being obtained there in this manner. Newcastle, co. Down, the specimen obtained was taken on a handline, when fishing for breams, westward of Crowrock, on a fine night. They not unfrequently leap into the canoes (Andrews). The same author refers to one taken at Ballina, in the county of Sligo.

This fish attains to at least 18 inches in length.

II.—FAMILY OF HERRINGS (*Clupeidæ*).

1. The Anchovy (*Engraulis encrasicholus*).

B. xii.-xiii., D. 15–18, P. 16–17, V. 7, A. 16–18, C. 21, L. l. 48–50, Vert. 46–47.

Length of head 4½ to 5; of caudal fin 7 to 7½; height of body 7 to 8 in the total length. *Eyes.*—Without adipose lids. Diameter ¼ of the length of the head, and ¾ of a diameter apart. Form of body slender, tapering towards both extremities; a little thicker along the back than along the abdomen. Snout very prominent and pointed. Cleft of mouth very deep, extending to beyond the hind edge of the eye. Upper jaw much longer than the lower. Gills cleft as far towards as to beneath the eyes. *Teeth.*—Present in both jaws; very fine in the lower; also on the palatines, and sometimes on the vomer. *Fins.*—The dorsal commences midway between the end of the snout and the base of the caudal fin. Anal very low. Caudal forked. *Scales.*—Very deciduous. Abdomen rounded, without any carinated edge. Two large scales on the base of the caudal fin. *Colours.*—Greenish along the back when alive; silvery on the sides and beneath. Soon after death the back becomes dark steel blue.

Habits.—Gregarious. At certain seasons of the year ascending rivers almost as far as the tide flows. It approaches the shore somewhat earlier than the large shoals of pilchards, and continues in shallow water until October or November; but it remains about the coast until February; while Couch obtained an example in March from the stomach of a mackerel. Dillwyn observed that off Swansea in some summers there are vast numbers in the bay. Along the Devonshire coast they appear to be rare. In November, 1871, Mr. Dunn reported upwards of 150,000 were taken in a pilchard seine-net in Mevagissey Bay; they were used for manure. He remarked that it is seldom they come so close inshore, although quantities hang about the coast. It is said to eat small crustacea, fry, and sea insects.

Means of capture.—Off our coasts they are mostly taken by chance in drift-nets or seines employed for the capture of sand-eels and other small fishes, their size enabling them to escape through the meshes of the nets, which are generally employed in localities which they frequent. In the Mediterranean they are fished for from May until July. Dark nights are selected, and each boat carries a torch to attract the fish, or a light is floated for this purpose. The shoals are encircled by small meshed nets, while the fishermen splash the water and endeavour to frighten the shoals, which rush headlong into the meshes of the net.

Breeding.—I have received them full of spawn in June, from Lancashire. Couch observes that they spawn from September until December, while in the Mediterranean their breeding time is said to be from May until July.

As food it is rarely eaten fresh, being bitter in taste, and poor. They are, however, prepared, and esteemed an excellent relish. Anchovies may be prepared by drawing off the head of the fish and removing the viscera. They are not washed or wiped, but packed into small casks of 5 lb. to 20 lb. weight, in layers alternately with a mixture of two ounces of Prunella salts (saltpetre deprived of its water of crystallisation by heat). They should be well pressed down and the air excluded. Anchovy sauce is made by bruising the fish and simmering it with butter over a slow fire ; a little vinegar and flour are added, and the fish dissolves in the process.

Habitat.—From Norway and the Baltic and North Sea along both coasts of France, but more abundant on the Mediterranean side ; the Iberian Peninsula, through the Mediterranean to the Black Sea.

It has been taken at Wick (Peach) ; Yorkshire (Yorkshire Vertebrata) ; Yarmouth, rare (Turner) ; frequently taken in the stow-nets during the summer months in the river opposite Lynn (Lowe); one 6½ inches long captured in January, 1867, at Boston, in Lincolnshire (C. Adcock). Yarrell received an example from the Thames, where, however, it is little known. Although not generally captured off Devonshire, large schools have been taken there, as in 1870. It is quite a common fish from Polperro to Falmouth (Dunn), Glamorganshire (Dillwyn), Flintshire (Pennant), and Lancashire.

In Ireland Andrews reports having taken it.

It seldom exceeds 6½ inches in length.

2. The Herring (*Clupea harengus*).

Names. — *Hæring*, Anglo-Saxon (*Herr* or *heer* "an army"); *cuddy legs*, "a large herring;" *corphun*, *herring cobs* or young herring in Northumberland, where they are likewise termed *silk-shag*. *Sgadan* or *scattan*, Moray Firth. Small ones not larger than a sprat are termed *sills* or *sile*; fat herrings destitute of roe *maties* or *matties*, a corruption of the term "maiden," or those which have never spawned; *full herrings* are those possessing a well-developed milt or roe; *shotten-herrings* or spent fish which, having just bred, are nearly worthless; it is likewise a term sometimes applied to such as have been gutted and dried for keeping; *green herrings* is a term sometimes employed for "fresh herrings." Red-finned herrings are known as *wine-drinkers* in Scotland, and as *loaders* in Norfolk and Lincolnshire, while in the western counties they are called *kings* and *queens*. *Over-day tarts* is applied by costermongers to such as have remained unsalted for twenty-four hours, and consequently are dark-red about their fins and gills, due to extravasated blood. A "blown herring" is termed, according to

Halliwell, a *tow-blowen* in Suffolk. A *gut-pock-herring* in Scotland is one which has its stomach distended with small crustaceans or other food. A *red herring* or a *black herring* are trade terms for particular descriptions of cured fish; while the former is also known as a *Norfolk capon*, and sailors usually designate it as a *sodger* or *soldier*. *Bloaters* used to be applied to herrings which were smoke-dried but not split open—from "bloat," to dry by smoke; *kippered herrings*, such as are split and salted. *White herring* generally implies a fresh herring, but in the North pickled ones are sometimes thus termed. In Scotland the highest brand is given to *mazy* herrings, or those full of roe; and what are known as *crown-fulls*, those which have not yet developed spawn, as matties; such as have spawned as *shotten*, but which find a ready sale in the great continental markets. At Great Yarmouth 4 herrings make *a warp;* a large basket containing 100 is termed *a swill*, or long take, 132; *a last* contains 13,200 fish. A *cran* in Scotland consists of 37½ imperial gallons, and generally contains from 900 to 1000 herrings; a *barrel* contains about 800. A *cade* or barrel of herrings appears to have contained 600 in the middle of the 15th century.

B. viii., D. 17–20, V. 9, A. 16–18, L. l. 53–60, Cæc. pyl. 18–23, Vert. 58.

Length of head 5; of caudal fin 6½; height of body 5 in the total length. *Eye.*—Situated half in front of the middle of the length of the head, and with an adipose lid on either side. Lower jaw prominent; the hind edge of the maxilla reaches to beneath the middle of the eye. Opercles smooth and destitute of radiating striations.

Teeth.—Small deciduous ones on the jaws, vomer and tongue, while generally minute ones are present on the palatines. *Fins.*—The dorsal commences midway between the end of the snout and the base of the caudal fin; the ventral is inserted on a line beneath the centre of the base of the dorsal fin. *Scales.*—There are thirteen rather soft scutes posterior to the base of the ventral fin, along the abdominal edge, and which are partially concealed by their neighbouring scales. The air-bladder has an opening on its lower side at about its centre, where a long but narrow canal forms a communication with the end of the stomach; it has also another orifice on the left side near the vent,* which canal is lined with a silvery pigment to within a short distance of its termination. The vessels of the air-bladder being scanty, gas is not secreted, but air believed to be swallowed. *Colours.*—Of a rich green along the back, becoming lighter on the sides and beneath, where it is shot with purple, blue, and gold hues.

Doubtless much of the following account of this fish has already been given by others, but were the subject not fully discussed it might be considered that I had left it incomplete. Differing from some popular accounts, I do not propose entering in detail with the development and anatomy of this fish, as such pertains more to the departments of the embryologist and comparative anatomist than to that of the fisherman, economic legislator, or the ichthyologist.

Habits.—The herring is a gregarious lively fish, a rapid surface swimmer, but somewhat timorous, whole shoals being frequently scared and turned from the course they had intended to pursue. The wake of these fish is often marked during the daytime by long lines of gulls and sea-birds hovering above them and occasionally swooping down upon some as prey; while at night time, especially if very dark, a slight gleam, "brimming" or "flame," is seen on the surface of the sea where the shoals are. But the herring is not always to be found at the surface, but seeks its food at any depth where it obtains the best supply; it may even sink down to the bottom, provided such be not too profound, still it is not uncommon both for it and the mackerel to be captured by the beam-trawl. Thus in the autumn of 1859 more than 1000 large and full herrings were caught off Lowestoft in a trawl-net, and in the spring of 1870 upwards of 5000 shotten herrings were similarly taken at the Well Bank off Great Yarmouth; and in March, 1881, a large number of both shotten and full herrings were taken on the Brown Bank (De Caux). It has been remarked along our south and south-west coasts that herrings and pilchards do not intermingle.

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* See figure in Weber "De aure et auditu," &c., pars. i. 1820, t. vii., 63.

The noise made by herrings when captured is peculiar, and has been likened to various things: to the cry of a mouse, to the word "cheese," a sneeze, or a squeak, and may be occasioned either by the escape of air through the posterior opening of the air-bladder near the vent, or else by some movement of the gills and gill-covers.*

The food upon which herrings subsist has been variously characterized, but generally held to consist of minute shrimp-like crustaceans, often of forms belonging to the same division as the common *Cyclops* of our fresh waters. It is very evident that they exist on very varied forms of animal life, and are probably not particular provided they can obtain sufficient. About the middle of February, 1882, I found that some from the south-west coast had been feeding on Annelids; from the same locality, in the middle of May, their stomachs were crammed with sand-launces,

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* It has been asserted that it is possible to blow air from the stomach into the air-bladder.

Ammodytes, some of which were up to 2½ inches in length, and as many as 19 were inside one herring, while the sand-launces in their turn were full of the remains of crustacea. A month later, from the same place, and captured at about 8 miles off shore, the food had again changed and consisted almost entirely of the young of a very rare gobioid fish, *Crystallogobius Nilssonii*, the largest of which was 1½ inches long; there were likewise a few young herrings and sand-launces.

Goodsir (*Edinburgh New Philosophical Journal*, July, 1843) gives the result of his examination of the *maidre* or food of the herrings in the Firth of Forth, with which the stomachs of the fish were found to be filled. Cirripeds, Crustaceans, and Acalepha were detected, of which crustaceans were in the largest number, and consisted of masses of *Amphipoda* and *Entomostraca*. Among the Acalepha the different species of *Beroe* were seen in the greatest numbers.

Off the Lofotens Sars found the sea swarming with microscopic animals, especially small crustaceans termed "herring food," *Calanidæ*, chiefly *Calanus finmarchius*, and *Temora longicornis*.

Carpenter, writing upon what they consume in North America, remarks that their food sometimes consists of smaller fishes, but generally of more minute animals, especially Entomostraca and Radiolaria, of which small reddish-brown aggregations are often found floating in the waters which they frequent.

Breeding herrings do not feed to the extent the others do.

For several reasons these fish are difficult to obtain for an aquarium. Mr. Stevenson (Mansion House Street) hatched some; the spawn was taken from the fish November 10th, 1870; by the 17th the eyes and movements of the young fish were plainly visible through a hand magnifier, and on the evening of the 24th (14 days after they had been taken from the parent and impregnated) many shells were found empty, but only one little one could be seen, for they are so minute and transparent that there is but little chance of finding them in a large body of water. By enclosing the ova in a suspended muslin receptacle in the tank several more were hatched out by the 29th. Dr. Meyer, respecting the experiments made in the North Sea, observes that no one has succeeded in rearing herrings from artificially fecundated eggs owing to the impossibility of arresting the formation of hyphæ of some fungus and the difficulty of obtaining suitable food; very soon after the yolk was consumed they died.

In an aquarium it was found (Zool. 1876, p. 4856) that the young or whitebait's diurnal and nocturnal movements were very dissimilar; in the former period they were quiet and uniform in going round their tank in one shoal, but at night the shoal was broken up, each fish taking an independent course for itself, darting about from side to side, striking against the rockwork with effects fatal to themselves, and which was only stopped by placing a dim light to illuminate the outline of the rockwork. Then they were most ravenous.

Herrings live in an aquarium provided, while being captured, their scales are not rubbed off, and Mr. Jackson suggests that the best plan is to dip them out of the sea in a bucket or can and subsequently allow them to swim into the tank they are to occupy. He invariably observed that they swam round and round their place of confinement in a circle from left to right. Occasionally one might turn for a moment, but it speedily resumed its place, and he never perceived the shoal to swim in a contrary direction.

Migrations.—Many theories have been broached to account for the migrations of the herrings, and it is still a subject which requires much elucidation.

Some suppose that this fish is not, strictly speaking, migratory, that is, that it does not travel comparatively far from the locality in which it was hatched, reared, and came to maturity, but simply changes from shallow to deep water, in accordance with temperature and the supply of food; one proof advanced being that certain definite varieties are present in certain waters. Where they conceal themselves is certainly remarkable; thus along the Devonshire and south-west coast of England, Mr. Dunn observes that should a gale spring up numbers are taken in nets purposely anchored parallel to the shore, and that they are meshed on the land side, although this locality had been unsuccessfully swept by seines and nets a very short time previously.

That herrings, in common with other species of the herring family, will occasionally disappear from one locality, sometimes re-appearing in another, is well known. From 1690 to 1709, a very extensive herring fishery existed at Cromarty; about the latter year an immense shoal was driven ashore near the town: they left the vicinity in a single night, and for upwards of half a century no shoals re-appeared: still this may have been simply a coincidence.

In Sweden it has been supposed that certain cycles occur during which herrings are found on their coasts; that the fish at the commencement of one of these cycles arrives late in December or January; by degrees they come earlier, and as soon as their advent is in October, it is considered that the cycle is about to terminate. The same irregularity of appearance has been observed in Norway, as regards their winter herring fishery, and the theory most generally accepted is that the fish have been at times compelled to go further out to sea during the summer in search of their food, and have been unable to return to the coast in time to spawn, so have deposited it upon some of the large banks in the middle of the North Sea. When the fish have not been seen off the coast, large numbers of whales and sea-birds, which live on herrings, have been observed off these banks. It has also been remarked that when these fish have reached the shore later than usual at the end of January or commencement of February, it is commonly a sign of their periodical disappearance.

The following figures show, as far as I have been able to ascertain, the presence or absence of herrings in Norway and Sweden :—

Years.	Norway.	Sweden.
1567–1589	absent	present
1590–1643	„	absent
1644–1650	present	„
1651–1665	absent	„
1666–1680	„	present
1681–1691	„	absent
1692–1746	present	„
1747–1784	„	present
1785–1808	absent	„
1809–1835	present	absent

In 1835, in Norway, they commenced to go south, and in 1877 they reappeared in Sweden.

The question arises whether, during the whole of these long periods of absence, the fish remained off the coast, but in the deep sea, while due to some unascertained influence they did not rise to near the surface nor approach the shoal waters? Or must we conclude that they were absent following their food, which from some cause was not present in its usual haunts? The explanation offered by the Norwegian Board of Fisheries appears to be that whether they come to spawn off the coast depends upon the distance they have to go in search of their summer food, while this in its turn depends upon the variation in the direction of the prevailing winds.

The two main objects of migration would appear to be seeking some locality where spawn may be safely deposited and the species continued; or else a search for food in order to maintain the growth and existence of the individual. But it would seem that fish may seek new ground, due to that they usually reside in becoming unsuited from any cause, as absence of food, or even their constant capture by incessant netting. If having selected waters further from the shore than formerly, the spawn were deposited and bred there, it does not seem unreasonable to suppose that the progeny would locate themselves where they were reared. In time, perhaps, this new location might be found unsuited, and the shoal might return to the spot they first inhabited, and where possibly a more abundant supply of surface food exists.

Respecting the effect of temperature and various meteorological conditions of the atmosphere as affecting migrations and captures, so little has yet been ascertained on these points that I think it better to refrain from speculating upon them. Fishermen assert that prevalent winds are a cause of migrations, and if so this is probably effected through its acting on their food. Seasonal changes, however, doubtless have an effect in hastening or retarding the advent of herrings; while diurnal variations may likewise be coincident with the bathymetrical depths at which they are found; storms may drive them from shallow to deeper water; and the herring season commences and also terminates earlier in the north than it does in the south; but much more than this facts scarcely warrant us to assume.

The Scotch Meteorological Society observe that the results of examining the daily register of thermometers used in twenty fishery districts on the east coast go to show a close relation between the fluctuations of the catches and changes of temperature, wind, sunshine, cloud, thunder and other weather phenomena. Maximum catches having been recorded when the temperature of the sea was about 55·5 degrees, while thunderstorms, if widespread, were followed for days with small catches over the area which had been covered by them.

Mr. Cleghorn concluded an interesting report upon these fisheries with a comprehensive summary; some of which were as follows: That there were fishing stations some years ago on the Scotch coast which are now exhausted, a steady increase having taken place in their produce up to a certain point, then violent fluctuations, and finally extinction. The races of herring near our large cities have disappeared first; and in districts where the tides are rapid, as among islands and in lochs, where the fishing grounds are circumscribed, the fishings are precarious and brief; while, on the other hand, extensive sea-boards having slack tides, with little accommodation for boats, are surer and of longer continuance as fishing stations.

I will now refer to the herring fisheries along the north-east and east coast of Scotland, respecting which we are told that "at the beginning of the present century herrings were so abundant along the north-east coast of Scotland, and came so close inshore that numbers of them were caught by people standing upon the rocks, having no other instrument of capture than baskets tied on long poles," a condition of affairs which hardly applies to the present time.

At Wick the largest race usually arrives with the new year, remaining until about March, and then disappears. Mr. Reid found in January, 1882, that some were a foot in length, and thick in proportion, but all were full of milt or roe. The next herrings come in May or June, in the shape of a few small ones of little value as food, although useful as bait for other fishes, and which appear to be the forerunners of the summer fish, as they grow better, larger, and fatter as the season advances, until they are in perfection about July and August, spawning about the end of the latter month or early in September, after which they disappear until the succeeding January. If we turn to the Herring Fishery Report of 1878, we are informed that "it is a very remarkable circumstance that the yield of the fishery at Wick began to decline at the very period at which the produce of the Aberdeenshire fisheries began to increase" (lxiii.). Here it would be as well to consider whether any change was during this period instituted in the working of the Wick fisheries which might account for the migrations of the fish elsewhere. Mitchell, who wrote in 1864, remarked on the herring appearing off Wick, the Moray Firth, and Aberdeenshire in June, but he observed they are at first so small that the nets cannot catch them, but they begin to be of sufficient size in July. (At this time the mesh of the nets was not less than one inch between knot and knot.*)

* Mr. de Caux observes that for the purpose of capturing herrings the mesh of the nets since 1864 has diminished off the Norfolk coast to forty or forty-four to the yard, ten to twenty years ago five-sixths of the catch were full fish, but for the last ten years the proportion has not been above two-fifths, due to the change in the mesh of the net; [illegible] immature herrings will take the salt, but they will not keep.

In the fourteen years from 1849 to 1862, 1003 boats were annually employed in fishing at Wick, with an average catch per boat of 133 barrels. During this period no winter fishing was carried on ; it now commenced, and in the fourteen years from 1863 to 1876, 885 boats were annually similarly employed, and the average catch per boat was 108 barrels. The witnesses condemned the decrease which had taken place in the size of the mesh of the nets, and in the change of shooting nets before sunset having become more common ; whilst it was noticed that the Wick Chamber of Commerce for some years gave a premium to the fishermen who landed the first herrings of the season ; thus fishing has gradually changed from July to the third week in June, the quality being small and mostly only fit for bait. This, it is stated, prematurely disturbs the shoals and injures the future prospect of the fishing.*

As the Wick herring fisheries from some cause diminished, those at Fraserburgh began to increase in yield. Here the same complaints were made as to the reduced size of the mesh of the nets and the taking of immature fish, but the fishing was said to commence about the middle or 20th of July, the fish being mostly taken further from shore than was formerly the case ; while it is continued, "there is now (1878) no winter fishing except for bait. The small fish do not fetch good prices, and are often condemned as unfit for food."

Herrings appear on the north-west coast of Scotland at the beginning or middle of May, when, during that and the subsequent month, they are mostly "matties." The great fishery there is in the Minch, between Long Island and the mainland, continuing until the end of July; while on the east coast the chief fishery begins about the middle or end of July until the end of September, the fish being full of roe; while the fishery at Loch Fyne and the south-west coast of Scotland coincides with that on the east, the fish likewise being in a similar condition. Off the coast of Ayrshire, on the Ballantrae Bank, the great fishery is during February and March. A short supply of summer herrings, observes Holdsworth, has been frequently accounted for by the preceding fishery having been largely worked. On the other hand, it has been contended that the summer fish are often as abundant as they ever were before the spring fishery ever came into fashion. Recent experience, however, does not support this statement, as with a more or less successful series of spring fisheries, the summer herrings have been exceedingly scarce for the last seven years ('Deep-Sea Fishing,' 1874, p. 123).

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* The same opinion seems to have found favour at Peterhead, Aberdeen, and Montrose, that the early fishing has a bad effect on the off-shore banks, increased by the repeal of the enactments against garvie-fishing, which occupation commences in November and occasionally lasts until March.

In the Moray Firth (Gordon, Zool., 1852, x. p. 3480) these fish are generally sought for during six weeks subsequent to the middle of July. They gradually move westwards, and congregate on the far-famed "Gwillam" Bank, about half a square mile in size and opposite the Bay of Cromarty. A storm sends them away, and they do not return that year. About the middle of August they swim lower in the water, and generally disappear in September. He also mentions "winter herrings," a stronger and larger variety, with fewer scales. At Aberdeen, July 4th, 1882, there was a fair catch of full herrings.

The Yarmouth herring fishing in 1881 commenced June 16th, but the fishery there and at Lowestoft generally extends from October to December 16th, during which period nearly 218 millions of fish were delivered at the wharves, which, at the wholesale price of £15 a last, shows a total of £250,000. Along the Devonshire coast, in 1880, this fishery commenced about November 13th, and a fortnight earlier than in 1879 (as was likewise the mackerel fishery).

In Devonshire and Cornwall there are two annual migrations of herring; the first, or *large herring*, with undeveloped roe, matties, approach the coast in May or June, a few being secured in the mackerel nets, while some continue to be so taken until the mackerel fishery ceases about July. About the same time, May or June, quantities pass up St. George's Channel to the Irish Sea, and are supposed by fishermen to remain in deep water. In June or July they proceed in a northerly direction, very few remaining off Cornwall, and they do not return there until October or November, or even as late as December; their migration towards the coast occurring especially if the weather is fine. Should a storm arise, they at once retire to the deep, and do not reappear off the coast until fine weather has recommenced. By February or March they become "shotten," poor and thin. Besides these large herrings, there is a migration of smaller ones early in November, which, as Mr. Dunn has observed in Cornwall, migrate to the west at the extreme northern extremity of the county. Various schools pass by Port Isaac, New Quay, St. Ives, around Land's End, and eastwards into Mount's Bay or by Falmouth and Mevagissey, finally stopping at Bigsbury Bay, the bottom of which is rocky, uneven, and covered with flexible corals (*Gongona*), and here they congregate until the January spawning season.

Means of capture.—For the purpose of indicating where the shoals of herring are, the presence of whales or flocks of sea-birds are often useful, but, if no such indications are present, the nets are frequently shot at a venture. Formerly it was the invariable custom to cast the nets by night, for fear of scaring the fish, but now this rule is being broken by some vessels. On very dark nights the phosphorescence of a shoal, if near, can be readily perceived; in fact, off the east coast, the majority of fishermen assert that they always wait until "the flame" is visible, and consider that they are able to tell the difference between "full" and "shotten" fish, a shoal of the former swimming close together in a compact body, whereas in the latter the individual fish are constantly dashing about. In some places the shad is termed the *damon herring*, and popularly believed to lead the shoals.

In fishing for herrings a number of drift-nets are joined together, and these are termed a "fleet," the length of each being about 20 yards, while from 101 to 181 comprise a fleet, the length of which, off the east coast, varies from 1¾ to 2 miles. The Scotch fleet consists of 48 pieces, each 40 yards long; they are made of cotton, which is found much more destructive than hemp, which was formerly employed. The mesh should be of sufficient size to allow the herring to obtain entrance for its head as far as its gills. During the autumnal herring season it has been computed that there are frequently from 8000 to 10,000 miles of nets in the North Sea at one time. In 1809 it was enacted that the size of the mesh should be 1 inch from knot to knot, or 4 inches all round, and in 1839 France signed a convention with Great Britain, constituting it the law for both countries; this was abrogated in 1862, and in 1868 the regulation was repealed. Since then the fishermen have reduced the size, and off the east coast the mesh has become from 40 to 44 to the yard, catching large ones by the snout, but allowing them to drop out and be lost.

Shoals of herrings have occasionally been met with of such considerable size that they have broken the warp-rope of the nets, and the whole of the gear has been carried to the bottom.

As herrings are caught at sea they are put into the hold and mixed with salt; ice may likewise be employed for this purpose. The fish first removed from the vessel are the most valuable, as having been subjected to less pressure and a purer atmosphere. As a rule, when the sea is calm and the temperature high, the takes become more or less spoiled before they can be landed; in some places the use of steamers has obviated this, and communications between the fishing fleet and the shore may be maintained, as at Montrose, by the employment of carrier pigeons. If the steamers were furnished with a double set of gear, so that the tanks containing the captured fish could be removed at once and fresh ones substituted, a tide would be gained to the manifest advantage of the fisheries, as the steamers could at once return to the fishing fleets. Mr. De Caux has given it as his opinion that the alterations in the fishery laws have been so mischievous that now, although the killing power of drifters in the same district (Yarmouth) has increased six-fold, the quantity of herrings captured has augmented but slightly, even if it has at all. On November 21st, 1882, it was observed that "Herring fishing at Great Yarmouth shows no falling off when compared with the previous part of the season. Nearly 8000 lasts have been landed, about 1600 more than at the corresponding time last year, and there are still two months in which to draw upon the shoals.'

On the Devonshire coast drift-nets and moored-nets in the bays are employed occasionally up to the end of February. Even so late as the middle of March, 1882, small boats were still capturing them with drift-nets off Plymouth, but the moored-nets had been laid up until the next season.

Along the Cornish coast there is no special fishery for herrings; some stragglers are taken in the mackerel-nets, and subsequently in the drift-nets employed fishing for the early shoals of pilchards, in July and August, when they are chiefly found in deep water, sometimes going east, sometimes west, in small shoals. Boats from Mount's Bay, Cornwall, and St. Ives leave for the Irish shores about the first week in June, and rendezvous at Howth, to the north of Dublin Bay, where the best fishing is about the last week in June or the first week in July; subsequently it generally decreases, and the boats go north.

Herring fishing may frequently have to be suspended or even entirely given up, due to stormy weather preventing fishermen from venturing out to sea. In 1880 the Scotch fishermen had a most successful year, but it was remarkable that "the greatest amount of success attended the efforts of the drift-net boats. The trawl-net boats were continually coming in clean, and, with rare exceptions, were very poorly fished until the recent cold, frosty weather set in, when some splendid takes were secured, yielding to each crew for one night's fishing from £100 to £200. Such a marked difference between the two modes of fishing has never been observed before, and as yet no real cause has been assigned for it."

The "dandy-line" is used for herring fishing at Peterhead during April, May, and June. A piece of lead about 1½ lb. in weight is attached to a line, which carries at short intervals transverse pieces of whalebone or cane having unbaited hooks at either end. Herrings are such hungry fish that they fly at the naked hooks, and are easily caught in this manner ('Angler's Note Book,' p. 48). The hooks must be kept moving about, and the water should be a little discoloured.

Along the coasts of Down and Antrim large quantities used to be taken by means of handlines, the hooks being dressed with feathers, and the time of fishing being evening or sunrise (Thompson).

Off Northumberland and Durham we are told that herrings used only to be fished when in their prime, or from July to September; now from 100 to 150 large boats come from Scotland every spring, and young herrings are captured from May right on, but they are poor and tasteless (G. Rowell, *Land and Water*, July, 1881). Mr. Southwell, in Norfolk, considers that there can be no two opinions as to the small size and inferior quality of the "spring herrings," and thinks that it is a matter of regret that they should be taken at that season.

Breeding.—The period at which the herring breeds is subject to great diversity, inasmuch that some persons have questioned whether it may not do so twice in one year. At Wick, on the north-east coast of Scotland, Mr. Reid informed me (January 18th, 1882) that early in January this year they were in a spawning condition, but no shotten ones as yet to be found, while they again spawn there in August and early in September. The same has been observed in the Moray Firth by Gordon. Herrings taken on the Ballintrae Bank, off the Ayrshire coast, in February and March, are either spawning or shotten. Herrings spawn on the east coast of England and Scotland (taking the extreme dates), from the latter end of May to December, that is, measuring from the Shetlands to the

North Foreland. These Ballintrae herrings never spawn in August, but, on the contrary, begin about the 1st of February, and the spawning goes on till the 1st of April. This spawning bank is ten miles long and two miles broad. The average depth is ten fathoms at low water (Buckland).

On January 5th, 1882, I found that most of the herrings in the fish-shops, and which had been received from Cornwall, were shotten; others were full of milt or roe. At the end of August, 1881, many were in full roe; and on December 13th I first saw some shotten* ones, but was informed some had been received previously. Mr. Dunn observed that all the herrings which visit the south coast of Devonshire late in November, throughout December, and early in January, are in spawning condition. Six hundred thousand were landed in Plymouth one day last week, and the spawn was almost ready for extrusion in the whole of them (*Land and Water*, December 24th, 1881). A month later he found at Mevagissey that the spawn was running from them. He considers that there are two herrings which spawn on the Cornish coast, the smaller in December and January, and which is not so regular and certain a visitor as the larger one, which spawns in February and March. The lesser ones seem to migrate along the coast, the larger ones to come from the deep sea. Andrews (February 14th, 1882), writing from Swanage in Dorsetshire, stated that he had two dozen brought to him five days previously, all full-roed, and many on the 14th; while the piermaster informed him that the first signs of spawning were noticed yesterday; while the fishermen reckon, as a rule, upon taking full fish more or less up to March. Mr. Wilcocks Field (February 25th, 1882) remarked from Plymouth that the herrings have not yet left the coast, and many among them have not yet spawned. It is evident that off Great Britain there are two chief periods for spawning, but that at various places some spawning fish may be captured at any month throughout the year. The autumn breeding time would appear to be the most extensive.

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* M. Bertrand, in his article on *Alose*, published in 1776, remarked that "it appeared certain that in the English Channel many herrings begin to spawn about November 25th, although in certain years some are still found full in February."

It now becomes necessary to consider what do we understand by whitebait? Here we must first seek for the origin of the term, and at the outset I am inclined to admit that such appears to be lost in obscurity. If we refer to Pennant's 'British Zoology,' volume the third, page 371, published in 1776, we read as follows:—"During the month of July there appear in the Thames, near Blackwall and Greenwich, innumerable multitudes of small fish, which are known to the Londoners by the name of whitebait. They are esteemed very delicious when fried with fine flour, and occasion, during the season, a vast resort of the lower order of epicures to the taverns contiguous to the places they are taken at."

Unable to trace the origin of the term whitebait, we have to investigate what has this fish been considered? Pennant states they belong neither to the shad nor the sprat, nor are they the young of smelts, but bear a great similarity to the bleak, to which fish he appended them, although with doubt. Donovan (1808) obtained as whitebait the young of the shad, and calmly expressed his opinion that Pennant never saw a whitebait, or, if he did, his examples were bad, or his investigations hasty and negligent, while his figure conveyed no just idea of the fish. Next we have Yarrell (1828), who considered that both Pennant and Donovan were in error, as he saw in these fish a new species of *Clupea*, which he termed *Clupea alba*. M. Valenciennes (1847) went still further, instituting a novel genus (*Rogenia*) for their reception, while he remarked that some young sprats were captured along with the true forms during the months of April, May, and June. Dr. Günther, the author of the 'Catalogue of Fishes in the British Museum (1867),' did not coincide with any of the four previous writers, retaining whitebait in the genus *Clupea*, and considering it to be the young of the common herring.

It is now universally admitted that the true whitebait belongs to some species of the herring family; but what we wish to ascertain is, are such mature forms, as asserted by Yarrell and Valenciennes, or immature fish, as believed in by the majority of inquirers, and, as such, were formerly protected by legislative enactments? In this investigation we must not lose sight of the fact that the herring family, more especially among the species composing the genus *Clupea*, possess many pelagic forms, which live together in large assemblages or schools, the young of which but rarely enter brackish, and never as a rule fresh, waters. That these fishes are very variable in their migrations: abundant some years, they occasionally forsake their haunts for several successive seasons, returning again in enormous quantities. This phenomenon is not peculiar to whitebait in European seas, but is found to be universal. Another peculiarity is that, the teeth being small and deciduous, a considerable diversity may exist in examples of the same species.

Are whitebait mature fish? This question has been answered by most investigators in the negative, by Yarrell in the affirmative; while fortunately the specimens of this last author, being still in the British Museum, are open to re-examination. All are certainly the young of the common herring. Yarrell remarked that these fish are taken in the Thames "from the beginning of April to the end of September . . . and specimens of the young fish of the year, 4 or 5 inches long, are then not uncommon, but mixed even at this late period of the season with others of very small size, as though the roe had continued to be deposited throughout the summer. Yet the parent fish are not caught." I have now a fine series of whitebait captured during the months referred to by Yarrell, and from the same locality (the Thames), and these I now propose enumerating, premising that, as the migrations of members of the herring family are variable, occasionally forsaking their usual spawning grounds, it does not appear improbable that one species may have left and given place to another, to be again changed to the original form on the return of the water to some condition which suited its first occupants. Thus Yarrell observes: "Formerly great quantities of the Twaite shad were caught with nets in that part of the Thames opposite Millbank, Westminster."

I examined 138 examples of whitebait taken during the months of May and June, 1878, the longest of which was 2½ inches; out of these about one in ten were sprats, the remainder the young of the herring. In August I examined forty-six examples from 2 to 3½ inches in length; out of these twenty-four from 2 to 2·7 inches long were sprats, and twenty-one, from 2·8 to 3½ inches long, were young herrings, these latter now commencing to grow to a larger size than their smaller relatives, the sprats. In October, out of forty-one examples from 2½ to 3½ inches in length, all were herrings. It appears that both sprats and young herrings find their way into the London market as whitebait. Some inquirers may obtain one species, some the other, while a third may receive both forms, in accordance with the locality the fishermen were working their nets, and whether schools of one or of both were present at the time.

Of the thirty-one examples of "winter whitebait" received from the Medway, twenty-six varied from 2 to 4½ inches in length, the larger ones possessing well-developed roe. All these were sprats. The remaining five were young herrings, from 5 to 7½ inches long, the largest having slightly developed roe.

How are these young fish to be distinguished? may be asked: and to this question a very simple reply will suffice. The sprats have sixteen to eighteen rays in the fin of the back, and seventeen to eighteen in that behind the vent. The ventral fins are situated beneath the first rays of the back fin. They have forty-seven or forty-eight vertebræ; no teeth in the front part of the palate (the vomer), and in a single or double row along the tongue, while internally they only possess seven or eight cæcal appendages at the pyloric end of the stomach, while the edge of the scales of the abdomen have very sharp points. The young herrings have seventeen to twenty rays in the fin of the back, and sixteen to eighteen in that behind the vent. The ventral fins are situated beneath the middle rays of the back fin. They have fifty-six vertebræ, teeth in the front part of the palate (the vomer), and in a long oval patch along the tongue, while internally they possess seventeen to twenty or more cæcal appendages at the pyloric end of the stomach. The keeled abdominal edge is not nearly so sharp as in the sprats, while the scales themselves are not spinate, and they do not fall off the body quite so readily as in the latter species, in which but few are seen on the sides in captured examples. Due to the position of the back fin, fishermen can recognise these two forms by holding them up by the dorsal fin, when the sprat trims by the head, but the herring by the tail.

That Pennant's was the whitebait of the present time there can be but little doubt, and likewise that it was the young herring. It is also certain that Donovan's figure is that of a young shad, the immature of which, if in sufficient numbers, would do as well as those of the herring or sprat served up as whitebait; while I certainly possess the young of these last two forms, which I have received as this fish.

During the summer and autumn of 1872 several hundred small whitebait were imported to Manchester from Colwyn Bay, North Wales. During the first eighteen months of their captivity they grew to at least half the size of a full-grown herring, with which species there was no gainsaying their identity (Zool. 1876, p. 4855). Meyer states his grew only to 1¼ inches in length in five months. Mr. Sim, of Aberdeen, observes that he found herring fry in the rock pools in great numbers in the months of June and July, all from 1¼ to 2½ inches long, and which he concluded were from the March spawning, or four to five months old.

As these fish augment in size they arrive at maturity, and very conflicting evidence has been adduced respecting the age at which they first breed. Some have believed they do so well within twelve months (De Caux); eighteen months has likewise been suggested (Mitchell); also that they are approaching the expiry of their second year before they shed their first spawn (Sim). This last supposition appears to me to be probably nearest the truth, taken in conjunction with the rate of growth of the species, the appearance of the young or sile, and the matties or maidens, arriving at the spawning period.

Herrings ready for spawning are termed *Mazy* in the trade at Yarmouth, and the fish appears to be in this condition all through the year at some part of our coasts. Some observers believe that they spawn twice a year, others as positively affirm the contrary, and it is much more probable to suppose that those which are spawning at different times are distinct races or schools.

The number of eggs which have been found in a single herring has varied from ten to thirty thousand ; when shed it sinks to the bottom of the sea, while along with it is a glairy fluid which enables the ova to adhere to any object with which it may come in contact. Ropes or nets drawn through herring spawn become thickly coated with it, and large quantities are brought on to the decks of fishing boats. Nets set in water where spawn exists in a very short time become treated similarly to what occurs when heavy catches of fish have been made. The locality selected is often over rough ground, while sea-weed may be found covered with this adhering spawn. In the Baltic and localities where the water is brackish, or almost fresh, they have been observed to select two or three feet of water for this purpose. It seems highly probable that they deposit their spawn wherever they happen to be, as herrings in which this was exuding were taken at least forty miles out at sea, or in forty to fifty fathoms of water, while it is very attractive to other fish, especially cod. Spawning fish are captured in shore and far out to sea at the same time, while shotten and mazy ones are frequently found together.

The escape of the young from the eggs either in spring or autumn can be considerably delayed by keeping the water very cold, while its saltness or the reverse exercises no appreciable difference.* Three to four weeks has been suggested as the probable time at which hatching normally occurs after extrusion; while if these eggs are heaped together they become mouldy, and no one appears to have succeeded in rearing these fish from artificially fecundated eggs. Meyer found that in a few days after being hatched they commenced preying upon microscopic forms existing in the water; after a month on small crustacea, and at the end of the third month they were a little over 1½ inches in length. Beyond five months he could not keep them alive. The young, known as whitebait, swarm along our shores in certain localities, sometimes to a great extent mixed up with sprats, at other times in independent assemblages.

Herring fisheries.—It would appear from the Commissioners' report that young herrings along the east coast of Scotland were first permitted to be captured in small-meshed, sprat, or garvie nets in 1868, the true garvie being the sprat, *Clupea sprattus*, and the young herring or whitebait belonging to the *C. harengus*. Some of the witnesses averred that when garvies are scarce, many young herrings are sent away with them, while it is impossible to take garvies without taking the young herring. One witness (p. 14) asserted having purchased thirty barrels of garvies in one day, and found they were all young herrings. My only personal experience consists of some garvies from the north-east coast, most of which were undoubtedly young herrings. They were about 3 inches each in length, requiring 288 to weigh a pound, or 645,120 to the ton. In the report so often referred to, we are told that 800,000,000 of herrings must be annually taken by Scotch fishermen alone, or equal to a little over 1240 tons of garvies, or young herrings, such as I have described; whilst from Inverness we are informed that in three years ending 1876–77, the Highland Railway carried on an average 267 tons of garvies annually to London.

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* In the Baltic the German Commissioners ascertained that with the water at 53° the eggs hatched in a week, whereas at 38° they took six weeks, while raising the temperature above 53° did not quicken the hatching process.

One argument, adduced in order to disprove that the destruction of fry inshore can do injury, has been that the young fish in our sandy bays and inshore grounds are the offspring from spawn shed at sea, and that it seems most likely that all the ova produced by those fishes which actually spawn in these bays are either washed ashore or drifted away. This would, in fact, amount to the opinion that inshore fry are naturally destroyed or drift away to sea, a conclusion opposed to what may be seen at any time along our shores where these minute fishes are killed in millions with small-meshed nets. Of this I will merely adduce one instance out of many, especially as the fact must be patent to everybody who examines the small-meshed nets used inshore during our spring, summer, and autumn months. Mr. Walton, of Bridgewater, purchased all the fish captured during one day in two hose nets at Bridgewater, and obtained 18 cwt. of the fry of soles, plaice, herrings, whiting, &c.

For reasons to be presently alluded to, I cannot resist expressing my individual regret at the manner in which the herring fisheries are now carried on, and how little they seem to be investigated by those whose duties ought to induce them to give this industry more consideration. For if inquirers are induced to turn their attention to these fisheries for a brief space, it is to be regretted how they ignore the warning of practical fishermen, and appear to consider (as did the Oyster Commissioners of old) that there are as good things in the sea as ever came out; while the idea of diminishing any supply from thence, they hold, can only be the views of such as know nothing of the ocean nor of its contents.

I would here venture to suggest as worthy of consideration a minute investigation of how these garvie fisheries are carried on from the commencement of October to the end of January; the proportion of herrings captured to sprats, and what becomes of the captures. It would also be very desirable that such an inquiry should extend into the question of whether or no the cessation of the inshore herring fisheries has been coincident with the extension of the garvie fisheries.

Off the coast of Norway the mode in which herring fishing is pursued is when the fish have entered one of the large inlets so common along the coast to stretch a net across the entrance and capture the entire school, fishing out at sea as off the Scottish and English coast being either unknown or else but little engaged in. Last year, 1882, the herrings appear to have been abundant off the coast, but as a rule to have ceased entering the inlets; as a consequence the captures have been comparatively few. The reason given is that of late years the whale fishery has been most successfully prosecuted, so much so that few cetaceans are now to be seen, while it is believed that the chief cause of driving herrings into inlets was to escape from the whales. The result is that petitions are being forwarded that no whales be killed within a certain distance of Norway. The terror of the nets in the inlets thus appears to have been less than the fear of the whales in the ocean; remove the whales, and one of the chief terrors, driving the fish into the outlets, has ceased to be present, and fishing will have to be carried on out at sea.

There are, it appears, two chief periods when herrings appear off the east coast of Scotland, while the winter, June, and garvie fisheries are partially or wholly new institutions. Whether they have or have not any bearing upon the cessation of the inshore herring fisheries I have not sufficient evidence to adduce. Still it is by no means impossible that some fishes, especially such as are of gregarious natures, mostly return to the place where they were reared. If, therefore, from any cause the inshore race of herrings were being unduly destroyed, it does not seem an unwarrantable conclusion to draw, that such may have something to do with the deep-sea race being now the most common along the east coast of Scotland.

Respecting the capture of the herrings off the east coast of Scotland, it is evident that the great bulk of the fishing is carried on much farther out to sea than it was a few years since. Still it does not seem at all proved that the inshore fishing has been neglected, but the probabilities are that the fish are no longer there in sufficient numbers to repay the fisherman's labour. It also seems doubtful whether the boats have really gone out so far as 110 miles herring fishing, as asserted by some of the local fishermen, for such a distance would necessitate the captures being salted at sea, or conveyed in ice, or by a more rapid mode of transit than simply sailing.

If we take the average capture of herrings as shown in the Scotch fishery reports* we find them as follows :—

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* These returns were from April to April up to 1843 ; those up to 1849 include those of the north-east of England ; from 1850 to 1868 they include those of the Isle of Man ; from 1869 they refer to Scotland only.

8 years ending	1816,	annual cure	132,837	barrels
10 „	1826	„	336,624	„
10 „	1836	„	392,860	„
10 „	1846	„	578,669	„
10 „	1856	„	640,593	„
10 „	1866	„	646,772	„
10 „	1876	„	806,563	„
For the year	1877	„	847,718	„
„	1878	„	905,768	„
„	1879	„	841,796	„
„	1880	„	1,473,600	„
„	1881	„	1,111,155	„

Thus we are able to observe a steady annual increase in the Scotch herrings when investigating the figures furnished us, from almost the commencement of the century. Everything is looked upon as denoting prosperity, and should every now and then a storm sweep the coast and numbers of fishermen be engulfed, such we are given to understand is unavoidable, incidental to all marine fisheries and incapable of remedy.

During this period, however, some questions omitted by the Commissioners appointed to investigate the condition of the Scotch herring fishery force themselves upon one's attention. First of all, one is led to ask what proportion of persons are now engaged in this occupation to the numbers that were thus employed at the commencement of the present century? Is the augmentation of captures due to increased facilities of capture, larger ventures in fisheries, or simply because the fish are more abundant?

The earliest date on which any confidence can be placed in the returns as to the number of fishermen* employed is from [illegible]* and I find that the number of barrels of cured herrings has gradually increased from about 379,000 in Scotland and the north-east coast of England until they have reached to upwards of a million during each of the last two years, while the fishermen and boys have increased by almost [illegible]. The proportion of the number of fishermen to barrels of herrings cured has averaged as follows:—

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* I do not allude to figures handed down prior to the commencement of this century. As, for instance, we are told that in 1667 the Scotch had 800 fishing boats, manned by upwards of 5000 men engaged in the herring fishery.

5	years	[illegible]	to	[illegible]	1 fisherman to	8	barrels	of herrings
5	„	[illegible]	„	[illegible]	„	8	„	„
5	„	[illegible]	„	[illegible]	„	9	„	„
5	„	[illegible]	„	[illegible]	„	10	„	„
[illegible]	„	[illegible]	„	[illegible]	„	10	„	„
5	„	[illegible]	„	[illegible]	„	14	„	„
5	„	[illegible]	„	[illegible]	„	15	„	„
5	„	[illegible]	„	[illegible]	„	15	„	„
5	„	[illegible]	„	[illegible]	„	15	„	„
5	„	[illegible]	„	[illegible]	„	17	„	„
5	„	[illegible]	„	[illegible]	„	19	„	„
5	„	[illegible]	„	[illegible]	„	22	„	„

The immense value to the community will be seen when attention is directed to the value of the fishing-gear in Scotland having averaged £1,26[illegible] for the last five years, while each barrel of cured herrings is estimated to be worth about 25s.

But when we enquire into the gear employed, we are told that cotton nets were coming in about 1856, but subsequently they rapidly superseded the hempen ones. A boat which used to carry 24 hemp nets, 40 yards long, equivalent to 960 yards of netting, now employs 50 to 60 cotton nets, each 60 yards long, equivalent to 3300 yards. The nets per boat, we are told, "used to present a catching surface of 3000 square yards, they now present a catching surface of 33,000 square yards." The Commissioners estimated, when giving the foregoing figures, that "each boat had increased its power five-fold." But the amount captured does not appear to have kept pace with the increased killing powers, for if so the fishermen who from 1825 to 1850, while employing hemp nets, obtained from 8 to 10 barrels per man, should now, were the proportions equal, be capturing from 40 to 50 barrels instead of about 22. It has been computed that there are 30,000 fishing vessels of about 280,000 tons tonnage, manned by 105,000 men and boys engaged around our islands, and most of which are at least occasionally engaged in the capture of herrings. But numerous other trades are dependent on the success or the reverse of this fishery.

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* This includes the line fishing, but the two are not separated; the proportions probably continue much the same.

Lastly, I would remark, that if herrings have, due to changes in our fishery laws and consequent methods of fishing, been unduly interfered with, so that the shoals are now further out to sea than was formerly the case, thus necessitating the employment of larger boats, has such occasioned a great loss of life? That going further out to sea to obtain these fish is a necessity is now admitted, while the harbour accommodation remains the same, boats are thus unable to enter during storms, and a great sacrifice of life is the result. This is another and most important factor which ought to be taken into consideration when deciding upon the necessity or the reverse for investigating the results which have followed the legislation of the last 18 or 20 years.

As food.—Herrings are very largely employed as food either in a fresh or cured condition. Of course in different localities these fish may be, and often are, differently treated; usually care is taken in selecting and assorting such fish as have to be cured, and also in obtaining the services of competent gutters, while the rapidity with which the varied processes are carried on, the seasoning of the barrels when such are used, and period at which they are fastened down, all are important factors in the condition in which the cured fish will be found.

In the north of Scotland the herrings on arrival are placed in a heap near the troughs of the curers, next they are gutted by individuals who at one cut remove the intestines and gills. They are then "roused" with salt in a tub, and lastly packed in layers in barrels, a handful of salt being sprinkled over each layer. As the fish subside a fresh layer is added, as the barrel has to be kept full. All broken or inferior fish, or those which have received too small an amount of salt, should be rejected.

Yarmouth bloaters are variously prepared, but one of the best solutions in which this can be effected is mixing 29 lbs. of common salt with 71 lbs. of water in large vats; in this the herring will float, so they are kept down by wooden battens weighted with bags of salt, which gradually dissolve and keep the solution at its proper density. When the fish have become rigid the pickle is run off and the herrings are suspended in a current of air until they are removed to a chimney and smoked from 12 to 18 hours, the fuel employed being 2 parts of oak-wood, beech-wood, and turf. These bloaters will keep 4 or 5 days, but are best if hanging in a current of air.

Red herrings are bloaters more strongly cured, the pickle having about $\frac{1}{16}$ of its weight of saltpetre added to the salt. They are dried for 24 to 48 hours and then smoked to the requisite tinge.

Kippered herrings are such as are pickled, dried, and split down the back almost to the tail fin, showing the backbone: the gills and intestines are removed, they are then cleaned with salt and water, and suspended for a night in a current of air and then smoked until they are of a light brown. They do not keep long.

The date of 1794 is given as that in which ice was first employed in Scotland to add to the herrings which were packed in boxes and sent by fast sailing vessels to London.

The present railway rates are levied in a most incomprehensible manner on the carriage of fish, rendering their being thus carried except, at a loss, often a matter of certainty: while in *Land and Water* (August, 1881) we read: "The charge for the carriage of herrings from Berwick-on-Tweed to London being the same as that from the extreme north of Scotland, although the distance is about 300 miles less, several herring buyers have complained of the unfairness, and have taken steps to obtain a revisal of the rate. This week they have sent their fish to London by steamer at a cost of 2*s.* 4*d.* per barrel. The railway rate varies from 7*s.* to 9*s.* per barrel."

Uses.—Largely employed as bait for cod, ling, and long lines generally, and they have, when very numerous, been boiled down for the oil which they contain.

Lacépède inquires "what honours are not justly his due who first taught mankind the art of impregnating the solids of the herring with sea salt?" Unhappily the subject is so interwoven with discrepancies as to date and nationality that no answer worthy of credit can be given. At the beginning of the twelfth century there were herring fisheries in the Baltic to which many foreign vessels resorted; these herrings must therefore have been *salted*—in fact in 1155 Louis VII. of France prohibited his subjects purchasing anything but mackerel and salted herrings at Estampes. In 1290 part of the dried fish shipped at Yarmouth, in the victualling of a vessel to bring the infant Queen of Scotland from her Norwegian sire, were *herrings*, and these, of course, were *cured*. In the time of Edward III. mention is made of some white herrings found in vessels captured by the Cinque Ports; and in the same reign *red* herrings are also specified by name, so that both sorts of curing were practised before the time of William Berkelszoon, of Biervliet, in Flanders (he died 1397), who has been credited with the distinction of introducing them. There is, however, no doubt that he greatly improved the methods he found in use by curing the fish in small kegs instead of piling them in heaps, which so extended the trade in them that Charles V. erected a statue to his memory, and, with his sister, visited his tomb, and offered up prayers for his soul; while Mary of Hungary, during her visit to the Low Countries, paid a more characteristic tribute to his memory, namely, that of eating a salt herring on his sepulchre.

In our own country the herring fishery certainly flourished in the twelfth century, for in 1195, according to historians, the town of Dunwich, in Suffolk, was obliged to furnish the king with twenty-four thousand herrings. Mention is also made of the herring fishery in a chronicle of the monastery of Evesham in 709. The herring fair in Yarmouth was regulated in the reign of Edward III. by the Statute of Herrings. On the old arms of the town were figured what are proverbially known as "Yarmouth capons," az., three herrings, arg.

In 1563 green or fresh herrings were so scarce, that at Yarmouth, at the great mart, they sold at an unusually high rate; a last, or eighty bushels, brought £9.

In France, until the close of the seventeenth century, fish diet was scrupulously observed on fast days. Thibaut VI., Count de Blois, gave annually (by charter, 1215) five hundred herrings to the hospital of Beaugency. Among the extensive charities of Saint Louis to monasteries and hospitals were sixty-eight thousand herrings. In olden times the soldiers engaged in warfare observed their Lent. Thus history informs us that while the English were besieging Orleans in 1428, one of the convoy of provisions destined for their camp was attacked by the Duke de Bourbon. It consisted chiefly of salted herrings, which gave rise to the conflict being called the "Battle of the Herrings."

A curious notice respecting the connection of herrings with marriages appeared in the *Times* (November 28, 1871). In the return for the third quarter of the year, the registrar of Fraserburgh stated that the herring fishery was very successful, and the value of the catch, including casks and curing, amounted to £130,000 sterling, and the marriages were eighty per cent. above the average. On the other hand, the registrar of Tarbert reported a steady falling off in the fishing at that creek, and consequently the quarter passed without an entry in the parish register. The registrar of Lochgilphead stated the herring fishery to have been a failure in the loch, and this accounted for a blank in the marriage column for the quarter. One registrar, in his return for the quarter, reported marriages in his district "like angels' visits, few and far between." At the fishing villages it might be put more briefly—no herring, no wedding.

Diseases and causes of destruction.—Whales, porpoises, seals, members of the cod family, dog-fishes, in short all predaceous fishes feed on herrings from the time of their birth and throughout their entire existence, and in this they are assisted by birds of various sorts. In the North

Sea the cod-fishes leave the sea bottom at night-time and ascend to the herring-nets, from whence they violently pull out quantities of the meshed fish and at the same time occasion much damage to the lighter kinds of cotton nets, in which they tear large holes.

Superstition enters largely into the composition of fishermen, and in the *Banff Journal* of 1855 it was recorded that the herring fishery being very backward, some of the fishermen of Buckie dressed a cooper in a flannel shirt with bars stuck all over it, and in this condition he was carried in procession through the town in a handbarrow. This was done to bring "better luck" to the fishing. A century or two ago not merely effigies, but living men and women were burnt on suspicion of casting a blight on the herring fishery; even at the present day it is common for whale-fishers to burn an effigy in order to "bring luck." If a ship has fallen in with few whales, the crew attribute their bad fortune to having some unlucky individual on board, and by burning his effigy they believe that his malign influence is got rid of. The most unpopular man in the ship is generally pitched upon as the offending party. Sometimes two or three "pictures" are burnt, one after the other, if luck is very bad. The practice is a very old one, and is said to have taken its rise from a similar custom which prevailed among the herring fishers of Banffshire, by whom it was introduced on board the Peterhead whalers.

In Norfolk (*Notes and Queries*, October 7th, 1865) we are told existed a fancy that fleas and herrings come together. "Lawk, sir," said an old fellow near Cromer, "times is as you may look in my flannel shirt and scarce see a flea, and then there aint but a very few herrings:

but times that'll be right alive with 'em, and then there's certain to be a sight of fish." Lowe, in his tour through the Orkneys (1774), says that as much as £50 was paid for the first barrel of herrings of the season that arrived from Shetland, this first instalment of the herring market being regarded there as medicine. *Red-finned ones* appear to be considered as omens of success on some parts of our coasts, and Mr. De Caux tells us that as soon as one is perceived it is taken from the net, carefully prevented from touching anything made of wood, and passed round the scudding-poles as many times as the fishermen desire to get lasts of herring at their next haul.

Habitat.—White Sea, extending into some parts of the Arctic Ocean; the colder to the temperate portions of the Atlantic, the North Sea and the Baltic.

In the Orkneys, Lowe observed that the Shetland Isles swarm with them in April and later, the east coast of Caithness in August, the Hebrides at the latter end of the year. The Sounds at certain seasons are alive with the fry. I have already alluded to their distribution along Scotland, the west coast of which country is studded with lochs from which they have commenced more or less to absent themselves, while along the east coast, possessing but three large bays or firths, they have latterly forsaken their haunts about 7 miles out to sea and receded to 20, 30, or even 100 miles. I have also alluded to the distribution of the herring on the British coast, while it is common around Ireland.

The size to which herrings attain varies. De Caux observes that the largest he has personally seen was 15¼ inches in length, but that Mr. Utting, of Great Yarmouth, had one which was 17 inches long, but the usual average off our east coast is from 10 to 11 inches, and if full weighing from 4 to 6 ounces: a full one, 11¼ inches long, will weigh 8 ounces. Buckland stated that the largest herrings submitted to him were from the Shetlands; the milt and roe were but slightly developed, they were very fat and as long as 9¼ inches and 9¼ ounces weight. Sims, at Aberdeen, weighed some full ones, 12¼ inches long, and they were only 8¼ ounces; the largest example he found in 1880 was 12¼ inches, and weighed 9¾ ounces; it was a full one.

2. The Pilchard (*Clupea pilchardus*).

A dried pilchard in Devonshire is sometimes termed a *fair maid*, derived from *fumado;* smaller forms go by the name of *sardines* when tinned. Halliwell gives *sarding* as synonymous with the pilchard. In Cornwall it is known as *hern*, *hernan* and *clean*. The term *pilchard* has been variously derived, some considering it to be from "pillch" an old English word signifying a piece of cloth to wrap round a young child, because these fish were formerly cooked in paper similarly to red mullets of the present day. It has also been derived from *peltzer*, a name by which it was known to some early northern continental authors. *Garvie-herring*, Scotland.

B. vi.–vii., D. 17–18, V. 6–8, A. 17, 18, L. l. 29–30, Cæc. pylori, numerous. Vert. 22 | 31.

Length of head 4¾ to 5⅓; height of body 4⅔ to 5; length of caudal fin 6 to 6¼ in the total length. *Eyes.*—With adipose lids, diameter of each 3¼ to 4 in the length of the head, 1¼ diameters from the end of the snout, and 1 apart. Lower jaw slightly prominent; the maxilla reaches to with the first third of the eye. Opercle with distinct and well-developed striæ descending towards the subopercle. *Teeth.*—In jaws excessively fine or absent, none on the palate nor on the tongue. *Fins.*—Origin of the dorsal fin nearer the snout than it is to the base of the caudal fin. Ventral inserted below the middle of the dorsal fin. Anal low, its last two rays slightly prolonged. Caudal deeply forked with two or three large scales at its base.

Scales.—17 to 19 scutes before and 14 posterior to the base of the ventral fin. *Colours.*—Greenish olive, with a bluish band along the body, and silvery sides.

Varieties.—It is by no means rare to see pilchards, even as many as 1 in 5 among thousands, sparingly marked with black spots, and which become still more apparent on the scales being removed. In some the eyes are black ringed, in others white; the former, according to Mr. Dunn's observations, being most numerous in the summer months, the latter in the autumn.

Habits.—Gregarious fishes, timid, being easily alarmed by noises. These fish congregate in dense masses by day, but as evening sets in they spread out along the shore (I am here alluding to St. Austell's Bay), apparently feeding from off the land, and so retire to the deeper waters with the return of the morning's light. At sundown nets are shot outside these feeding-places, thus arresting the shoals in their progress towards the deep sea, while, during the daytime, these fish are taken on the deep-sea side of the nets.

They have been known to ascend into brackish water when under the influence of fear; thus, in 1722, a large number were taken in the Dart at Totnes weir, having been chased there by porpoises; and in July, 1880, when it was nearly low water, one was seen coming down the same river by persons standing on Totnes Bridge, which is twelve miles from the sea, pursued by an otter; the pilchard leaped on the bank and was secured.*

They will eat the roe of the cod or ling voraciously, also crumbs of bread. Off the French coast, salted fish roe, mostly of the cod, but also of the mackerel mixed with the pounded flesh of that fish is employed to attract pilchards. It is termed *resure*, *rave*, or more commonly *rogue*, and is largely brought from Norway, more especially from Drontheim. The fishermen say that they have seen pilchards in multitudes quiescent at the bottom of the sea, as if examining with their mouths the sand and small stones in the shallow water, and probably hunting for food, the largest fish, similar to the mackerel, being furthest out to sea. Mr. Fox, some years since, observed that a hogshead of pilchards is 376 lbs. gross and 340 lbs. net. Summer fish run 3000 to 3600 per hogshead, and winter fish 2400 to 2800. Mr. Dunn found that at Mevagissey pilchards of late years have averaged, from August 1st to November 1st, from 3300 to 3800 per hogshead.

Migrations.—These fish are found off the coast of Cornwall and Devonshire throughout the year. In January they keep near the bottom, and are frequently taken from the stomachs of line-caught fish. Considerable assemblages have been observed in February, becoming more abundant in March; but the chief fishery commences with drift-nets in July and with seines in the succeeding month. During the summer they may be met with from twenty to fifty miles from the coast, as outside the Scilly Isles and a considerable distance up St. George's Channel. In or about August large schools of these fish extend from the Lizard so far as Bolt Head in Devonshire, further to the eastwards of which no very extensive fishery is carried on, although considerable numbers are taken at Torbay, Teignmouth, and Dawlish. Another large fishery—in fact, a continuation of that already referred to—stretches from the Lizard to the Land's End; while a third is present on the north coast of Cornwall, having its chief seat at St. Ives, where the fishermen assert pilchards arrive in October and November, about three days subsequent to their appearance at Kinsale, in Ireland. Sometimes one of these districts is full of fish, none being present in either of the others. Irrespective of these larger migrations, there are lesser ones, influenced by currents, tides, and searchings for food. They appear rarely to go directly against a current.

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* In 'Natural History of Ireland' (1755, p. 192) exists an extract from a letter from the Archbishop of Dublin, wherein he observes: "There was a good fishery of pilchards on the south coast of Ireland before the year 1688; but since the fight in Bantry Bay between some of the English fleet, under Sir George Rook, and the French in 1689, the pilchards, I understand, have not been on that coast; the reason of their leaving it is supposed to be the shock given by the firing of guns; and it was observed that some gentlemen, having provided a yacht for their pleasure, and firing their guns frequently in the Bay of Dublin, the herring fishery in the Bay failed entirely that season." Couch observes, that the firing of a heavy gun at the distance of twenty miles has been known to cause the fish to sink, and thus disappoint the labour of the fishermen.

Many of the fishermen assert that the number of pilchards now captured in Cornwall is much less than used to be the case. They point out numerous small landing-stages, all of which in remote ages were used for disembarking the fishermen's spoils, but have now fallen into ruin or crumbled to decay, owing to there being no longer any need for their services. It has been said that the pilchards in some seasons swim low, due to diminished temperature in the upper waters, or from some other cause, and consequently escape beneath the nets. This reason might hold good at certain periods, but, as such could only be temporary, it would not account for any steady yearly decrease in the takes.

Pilchards taken off the south-west coast of Great Britain are larger and fatter than such as are captured in the Mediterranean in the opinion of most foreign fishermen who have plied their occupation in both localities; but along the Devonshire and Cornish coasts they are much more abundant in certain years than they are in others, while Mr. Dunn has remarked at Mevagissey that in seasons of plenty three gallons of oil are obtainable from every hogshead of fish, whereas in bad seasons, the fish being few, only about one gallon of oil can be extracted from the same quantity. In this computation, the summer shoals alone are alluded to, as during the winter months the yield is hardly more than half what it is in the warmer times of the year. This must force the inquiry of, Why is it that when pilchards are few, or the weather cold, they yield less oil? for, if the food were invariably the same, or present in sufficient quantities, a natural conclusion would be that a smaller army of fish would find more sustenance for each individual which formed its component parts, and consequently they ought to be in a better condition. It may be put down to disease, debility, or a diminution in the food supply. If disease were the cause, it is most probable that the fishermen would observe some, at least, of its symptoms or effects in their captures, whereas none has been noted.

The amount taken of the summer fish is not an invariable index to the quantity present, but more depending upon the course they select; for, if they keep in deep water, they avoid the seines; and should they swim low, they escape the drift-nets.

Mr. Dunn observes that during May and June these fish appear to be in the deep waters of the English Channel; that, at this period, the mackerel nets used off Penzance have a large mesh for the purpose of taking the large mackerel, and through this pilchards can easily pass; whereas, at Mevagissey, the nets used are for the lesser-sized mackerel, for which purpose a smaller mesh is necessarily employed. In this the pilchards mesh or entangle themselves when full of roe, being unable to pass through.

The fishermen returning from the east coast towards Cornwall in the autumn often pass quantities of pilchards in the English Channel, especially off and beyond Portland.

Couch observed that for several years in the early part of this century the larger proportion of the shoals consisted of such small fish that they passed through the meshes of the seines. Mr. Wilcocks also met with similar sardine-sized pilchards in Guernsey.

Means of capture.—This is carried on by means of drift- or driving-nets that can be employed over any depth of water, and seines or seans, or circle nets, which are used near the shore. Drift-net fishing for pilchards has much increased of late years, and the same boats, from 8 to 16 tons, are employed in it as are used for mackerel and herring.

Seine-nets are differently worked and shot between sunrise and sunset, the smallest legal ones at St. Ives being 160 fathoms along the cork rope, with a depth of 8 fathoms at the centre or bunt, and 6 at the end of the wings. Some are as long as 200 fathoms, the mesh being [illegible] of an inch between knot and knot, or 18 to 20 to a foot; 18 feet of netting are attached to each 11 feet of back rope, and the same amount on each 10 feet of foot rope. A line of corks goes along the upper edge, and the foot-line is weighted with leads.

In consequence of the interference of drift-boats with the working of seines on the coast of Cornwall, the following restrictions were inserted in the Sea Fisheries Act, 1868, 31 & 32 Vict. cap. 45, s. 68:—

"On the coast of Cornwall, except so much of the north coast as lies east of Trevose Head, no person between the 25th of July and the 25th of November in any year—

> "(*a*) Shall, from sunrise to sunset, within the distance of two miles from the coast, measured from low water-mark (whether in bays or not), use a drift-net or trawl-net; or (*b*) shall, within half a mile of any sea fishing-boat stationed for seine-fishing, anchor any sea-fishing or other boat (not being a boat engaged in seine-fishing), or lay, set, or use any net, boulter, or implement of sea-fishing (except for the purpose of seine-fishing).

"Any person who acts in contravention of this section shall be liable on summary conviction to a penalty not exceeding twenty pounds."

As there are only six stations, locally termed stems, at St. Ives, where seining can be carried on, and nearly 250 registered nets, they are arranged in groups, each of which is worked so many times in accordance with its size.

Huers, also termed *balkers*, are employed for the purpose of keeping a look-out from the cliffs along the shore for the schools of pilchards, similarly, as already described, for observing the mackerel. They receive each about £3 a month, and one-hundredth part in kind of the fish taken by their respective companies. Fish being seen, the cry is raised, "Hev ah! hev ah!" And about 1604 it was enacted that no action for trespass would lie against these people for going on any lands when in pursuit of their [illegible]lling. It was also permitted to fishermen to haul their nets on to the nearest shore. The fishery carried on during the last six months of the year is the most important, because pilchards are then in a condition in which they will cure or "save" best, being fat and with undeveloped roes. Of late years large quantities have been taken during the first six months of the year; these are purchased by local dealers, and forwarded by rail to provincial and Welsh markets under the term of "white herrings."

Mr. Dunn observes that off Mevagissey he has known of three pilchards having been captured by hook and line, the bait being a small piece cut out of the side of another pilchard; while Couch had been informed of two or three instances in which this fish has been known to swallow the fisherman's hook baited with a worm.

To a stranger visiting the fishing-quay at Mevagissey an hour or so after midnight, when the pilchards are being landed and sold by their captors, the scene is by no means devoid of interest. The jowters, with their light traps and fast-trotting hacks, are assembled ready to purchase the fish they require, and scour the country in order to retail them to the inhabitants of every village and hamlet. The pilchards, having been washed, are packed in layers, between each of which salt is sprinkled; this assists in retarding decomposition in these fish, which are so prone to become putrid. At the Barbican, at Plymouth, much the same scene may be witnessed, but pilchards are not to be had in sufficient quantities, and cartloads of the coarser description of fish are circulated from there by means of these jowters.

Twelve thousand hogsheads of pilchards are annually exported from Cornwall, and the autumn fish being more firm and less oily are generally preferred for the Italian market.

A large trade in cured pilchards is carried on between Cornwall and Spain, the idea having originated at Mevagissey as follows:—In 1876, observed Mr. Dunn (*Land and Water*, November 18th, 1882), a fish-curer here found there was a demand in the Mediterranean fish markets for bright-salted pilchards. He first thought the matter out, and then proceeded and cured several tons of pilchards by throwing them with salt into barrels and allowing the brine to rise over them. After keeping them steeped for some weeks they were washed, packed, and pressed into clean barrels, just as was formerly done by the old-fashioned fumadoes. On their being put on the market it was at once seen they were the article wanted, for these fish, instead of having the dirty-yellow hue of the fumade, had the desired bright and clean silvery colour, hence they have been in demand ever since. The fish-curer in question took out no patent rights, but allowed all to use his discovery, so much so that for some seasons past not less than 1000 hogshead of fish yearly have been shipped for the Mediterranean from Mevagissey alone. The barrels first used have been superseded by large steeping vats, one of which here will hold over 500,000 fish. Since the business in question has been progressing, it has been discovered that the Spaniards cure sardines much after the same manner.

Fumados* are thus prepared: a layer of salt is first placed on the floor, then a layer of fish, and so on up to from 3 to 5 feet high, the outermost row of fish having their heads out and slightly turned up, and the inner rows at right angles to them. French or Spanish salt, being of a coarser grain than English, is preferred. The bulk remains thus about a month, and the oil as well as the brine which drains from them is collected into a receiver. They are now

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[*] The name indicates that these fish were formerly smoked.

cleaned, the dry salt is removed by a sieve, they are subsequently washed and packed in regular order in 50-gallon casks, the fishes' tails being directed to the centre. Pressure is now made by means of levers, to which weights are hung, the casks being refilled and pressed three times during nine days. A hogshead should weigh 476 lb., while the number of fish in each cask vary from 2500 to 3000. All fish under 8 inches in length are excluded. (Fox.)

Sardines are prepared at Mevagissey as follows: Immediately the fish are landed they are taken to the factory and cleaned; then the washers arrange them in light trays head downwards to drain and dry. They are next boiled, then packed in tin boxes, which are filled up with the best olive oil, and subsequently soldered down. These tins are again boiled, and the fish are ready for the market.

An experiment made to smoke them like herrings failed, as the weight of the body caused the fish to give way and fall into the fire.

Breeding.—Off the coast of Cornwall Mr. Dunn observed that it appears to breed at two seasons of the year, May and June, also in December, and the young are first seen in September 3 or 4 inches in length, and about one-eighth of an ounce in weight. On January 16th, 1882, these fish were returning to the bays shotten, and one boat took 6000. Couch placed the winter breeding as commencing as early as October, but this of course would vary with the temperature of the season. I opened large numbers in the month of August, but in only one single instance did I find developed spawn. The pilchard deposits about 60,000 eggs, and falls off in condition as spawning time is approached.

Off Mevagissey they have seldom been observed to spawn within 10 miles of land, usually from 20 to 30 miles off shore; the first-named of these localities is generally chosen in the summer, the latter in the winter or spring.

Couch observed that the males exceed the females in number.

Mr. Dunn recorded that he has seen the roe pressed from the fish when alive into a bucket of water, and each of the ova rests just below the surface.

Diseases and causes of destruction.—The picked dog-fish, *Acanthias vulgaris*, is partial to these fish, pursuing the shoals, and even tearing them out of the fisherman's nets. Mr. Dunn, writing from Mevagissey (December 4th, 1882), observed how these predatory vermin in many instances rushed in numbers at the netted fish, eating all the captures, and doing so much mischief that some boats had their nets entirely destroyed; other boats left the ground, which is within a few miles of the Eddystone rocks; while at one time it was thought probable that the fishery would have to be entirely given up. Other forms of predatory fishes, porpoises, and birds likewise prey extensively upon them.

It is not unusual to see these fish removed from the nets with one or both eyes gone, not I think due to the gar-fish, *Belone*, or the saury, *Sambresox*, having pierced their heads, but consequent upon attacks of fish parasites. In several instances in which both eyes were gone I found the bony interorbital septum still intact, which it could not be had the fish been pierced through the two eyes. It is found with *Lerneæ* perforating its eye, as seen in sprats.

As food.—These fish are much esteemed in Cornwall, eaten fresh. Halliwell mentions a Cornwall dish as starry-gazy-pie, being one made of pilchards and leeks—the heads of the fish appearing through the crust as if they were eyeing the stars.

The chief market for cured pilchards is Italy, where there is a great demand both before and during Lent.

Uses.—As bait pilchards are found to be more attractive than herrings, probably due to the large amount of oil which exudes from them. Pilchard oil possesses a more greasy nature than that of other fishes, and is on that account considered excellent for coarse painting, while it was formerly consumed in lamps in Cornwall. It is also employed by curriers in preparing leather. This oil was one of the chief items calculated upon towards defraying curing charges. Its value is now reduced, but during the last twenty years it has not fallen below £20 a ton.

Habitat.—There exists a large fishery for sprats in the Zuider Zee, the quality of the fish obtained there being generally excellent. In 1882 the fishing closed about August, and seventy millions of fish, realizing £70,000, were secured, as against sixty millions in 1881. Pilchards are found off the French and Spanish coasts extending to Madeira, and the variety sardine is found through the Mediterranean.

At Aberdeen an example was taken among some herrings in November, 1881 (Sim), Firth of Forth (Parnell). Occasional visitor off Yorkshire (Yorkshire Vertibrata). A few have been taken off Dover, and every year off Yarmouth (Yarrell), Harwich (Dale), also in the Downs and in the Isle of Wight by herring fishers. In May, 1838, Yarrell obtained one from the Thames. Under the head of migration I have alluded to their distribution along the south and south-west coasts of England.

In Ireland it is chiefly taken along the south coast, where a few occur every year, while occasionally large numbers are captured. It has been recorded from Belfast Bay, Newcastle (county Down), Youghal, and the south-west of the counties of Cork and Galway.

The pilchard rarely exceeds 11 inches in length; but Mr. Cornish (Zool. 1879, p. 62) observed that on December 29th, 1878, he measured the largest he had ever seen, and that it was 11⅞ inches long, while Couch remarks that it has been seen of the length of 14 inches.

The Sprat (*Clupea sprattus*).

Garvie—garvock, Scotland. *Sprat*, besides being the name of this fish, is in places erroneously employed for the young of the herring. *Britt*, along the Devonshire coast, which ascends the mouths of rivers, consists either of young sprats or young herrings. Whitebait likewise may be wholly or partially composed of small sprats. In Ireland the fishermen at Youghal distinguish several varieties as *true*, *soft*, or *hard-headed* sprats.

B. vi.–vii., D. 17–18, P. 16, V. 7, A. 17–20, C. 19, L. l. 47, L. tr. 13, Cæc. pyl. 7, Vert. 47–48.

Length of head 4½ to 5¼; of caudal fin 6; height of body 5¼ in the total length. *Eyes.*—With narrow anterior and posterior adipose lids; diameter 3½ in the length of the head, 1 diameter from the end of the snout, and ¾ of a diameter apart. Lower jaw prominent. Opercular pieces smooth, subopercle almost triangular, its posterior and inferior borders being continuous. The posterior extremity of the maxilla reaches to beneath the first third of the orbit. *Teeth.*—Absent from the jaws, tongue and palate (an elongated, oval patch of very minute teeth on the tongue has been recorded; in an example 4½ inches in length none are visible under a ½-inch power of the microscope). *Gill-rakers.*—Closely set, rather shorter than the eye. *Fins.*—The dorsal commences about midway between the hind edge of the eye and the base of the caudal fin, being rather longer at its base than it is high anteriorly. Ventrals inserted on a vertical line below the anterior dorsal rays, the fin reaches about half-way to the vent. Pectoral shorter than the head. Caudal forked. *Scales.*—Deciduous, smooth; the keeled row along the ventral surface well developed, and the scutes being a portion of the scale, causing that edge to resemble a saw, 21 to 23 being before the base of the ventral fin and 11 or 12 behind it. *Intestines.*—Seven rather long cæcal appendages. *Colours.*—Bluish along the back, becoming silvery on the sides and beneath; in the young a yellow or bronze band divides the blue of the back from the silvery abdomen.

Habits.—Gregarious, often in enormous shoals, while it is very common to find young and old together, although the larger examples do not generally come off our coast until the autumn and winter months. They ascend rivers as high as the tide flows. Britt, which consist of young herrings or young sprats, ascend rivers along the Devonshire coast, and are found as high in the Exe as Exeter, unless a flood occurs, when they are unable to face the fresh water.

Migrations.—Although during the very cold months herrings, pilchards, &c., more or less retire to the deep, sprats on the contrary come towards the shore, but even when present the shoals are capricious in their movements as well as in their extent. Norfolk, Suffolk, Essex, and Kent are noted for the large shoals which occasionally show themselves, while they disappear more completely from the western side of the kingdom during their season of absence than they do from the eastern. Even the season of appearance varies considerably in different years at the same place. During the summer and autumn months young or small inshore sprats are rarely absent from our coasts. In the Moray Firth and elsewhere shoals are frequently discovered by seeing flocks of gulls and other sea-birds hovering above them.

Means of capture.—These fish are mostly captured during the winter months, whether in Scotland or in England. In 1880 this fishery commenced in the Beauly Firth on October 12th; but in the south-west of Ireland it is earlier, and in Donegal Bay continues from August until nearly the end of December. When fished for in the sea they are generally taken from close inshore to about three miles out.

Sprats are generally taken by means of a large bag-net, made with small meshes, and termed a stow-net, the use of which was formerly forbidden between November 10th and February 10th, but which is now the principal time it is carried on; while ground seines were legal between November 1st and April 1st. The stow-net is placed in a tideway, its mouth towards the tide. In Scotland the seine-net is used for taking these fishes, while off Ramsgate drift-nets are also employed for sprat fishing.

In Ireland the sprat fishing is carried on during the autumn months, and Mr. Sinclair, writing from Donegal (*Field*, November 5th, 1881), observes that the sprat fishing is now over.

One method adverted to by Mr. Yescombe, in *Land and Water* (November 26th, 1881), is to choose the vicinity of an old wooden pier, or some such structure, round the supports of which small shoals of sprats frequent. Secure your boat to the end of one of these piles on a fine day. Use a net attached to a thin iron hoop about 3 yards in circumference, and which is suspended by three cords fixed to it at about 3 feet apart. About a foot above the ring of the net these cords are tied together, and attached to a single strong one. The net is lowered into the water to about 2 feet below the surface, and some fine boiled mealy potatoes thrown in, which attract the sprats above it. Then allow it to be quietly drawn up with the fish that are swimming above it, and the shoal does not become alarmed.

Said not to be taken by a bait, probably due to the small size of its mouth.

Breeding.—I have obtained sprats with developed roe from both the north and south coasts of Cornwall during the months of December and January, but it is not common to find them in this condition. Neither Pennant, Turton, Jenyns, or White advert to the breeding of these fish, but Yarrell states he caught young sprats off Ramsgate, Hastings, and Weymouth in the months of August and September. Lowe ('Fauna of Norfolk,' 1873, p. 29) remarks: "Mr. Dowell says that though he has seen vast quantities of this fish caught, he never yet saw one with roe." Couch observes that uncertainty appears to exist in regard to the season of spawning, which, however, occurs in summer, and probably late in the autumn also.

Diseases.—Mr. Warren (in Thompson's 'Ireland') observes that "about Christmas, 1846, vast numbers of sprats died in Cork Harbour, and were carried off in basketsful dying and dead. The people ate them, and considered them very good; it was the year of the famine. They had mostly a 'pearl,' or white, appearance in the eye while living; some had both eyes, and others only one of them, diseased."

One form of parasitic entomostraca, *Lerneonema monilaris*, or sprat Lernea, is often found attached to the eye of this fish. The whole head of this parasite is inserted into the tissues of its host, and retained there, due to the barbs or horny prolongations with which it is furnished. This Lernea is luminous at night time, and fishermen assert that shoals of sprats are often preceded by several of these fishes infested by parasites, and which have occasioned them to be termed "lanthorn sprats."

The britt in Devonshire and Cornwall have been considered by some to be the young of the "herring," but those which I received from Plymouth were "sprats." The Town Council of Exeter annually make an official whitebait repast upon "britt," respecting which discussions have arisen as to whether they are or are not similar to the genuine Thames and Medway species. It appears that in the Exe they ascend with the tide so far as the entrance of the Exeter canal, where they are found from May until September. Mr. Ross (MSS.) recorded in 1838 that he took some of these fish to London to Mr. Yarrell, who decided they were the fry of the "shad." Mr. Couch subsequently considered them to be "whitebait," but not the young of the "herring." Mr. D'Urban, the curator of the Albert Memorial Museum at Exeter, transmitted specimens to me which were the young of the "herring."

Continuing my investigations into the britt along the south-west coast, I arrived on August 23rd at Dawlish, and at the beach was in time to see the seine-net hauled on shore, and as the bagged portion came to the surface innumerable little silvery fishes seemed to shoot through the meshes into the sea, but hundreds were landed with the refuse, some of which I secured. This gave me another opportunity of examining the August britt. The fishermen considered they were all young sprats, and such I found them to be, while their size varied from ¾ of an inch to 2¼ inches in length.

It may be that the britt present at the mouth of the Exe from May until September vary with the season, for when investigating the whitebait question in 1878, among examples from the Thames and Medway, I found the proportions of herrings to sprats to be about as follows: May and June, ten to one; August, sprats rather more than half; October, all herrings; while of the winter whitebait given me by Mr. Charles from the Medway, all were sprats. On August 13th, this year (1881), innumerable young sprats were being taken at the same place as bait for gurnards, although they appeared to be entirely absent from Penzance, which was locally attributed to the bay being too sandy; and I saw a solitary example at Mevagissey, captured among pilchards.

As food.—These fish are very deservedly esteemed, especially when not too large. As they are nutritious and cheap, they are a boon to the poorer classes. They are sold by measure.

In some parts of Scotland they are thus preserved: selected fish are washed in salt and water, then threaded on wire skewers, and suspended for two hours in a pickling vat, so that no two fishes touch one another. On being removed they are hung up in a current of air until the next day, when they are smoked like bloaters, until they assume a yellow colour. They will keep four or five days, and additional pickling and smoking will enable them to keep longer.

An important trade appears to be springing up at Lowestoft, where they are being tinned as anchovies. Three million tins of sprats, similarly cured as anchovies on the west coast of France, are annually imported into this country. Those taken off Finisterre are found to possess a muddy flavour, but they are exported by some second-rate mercantile houses.

A so-called anchovy paste may be made as follows, sufficient for a peck of sprats: 2 lb. common salt, 3 oz. bay-salt, 1 lb. saltpetre, 2 oz. of prunella, and a few grains of cochineal, pounded well together in a mortar; into a stone jar place first a layer of fish, then of the pounded ingredients, and so on until the jar is filled, press them hard down and cover closely: after six months they will be ready for use.

Uses.—As bait for ground-fish, for which purpose their oily nature makes them very acceptable. Large quantities in some years are disposed of for manure, which may be due to the markets being glutted, or else that by the time the fish have been landed those which were first caught are fit for nothing else. In some localities they are even fished for solely with the view of being employed as manure.

Habitat.—From the Finnish coast, through the North Sea and Baltic, also along the coasts of the British Isles, France, and the Iberian Peninsula: also Tasmania.

In the Moray Firth it is abundant on the east side towards the end of the herring season; subsequently it passes westwards towards the more sheltered parts. Parnell remarks that it is found on the Firth of Forth throughout the year, but, like many small animals, it appears to be very susceptible to cold; while, during the warm summer months, it may be seen sporting about in large shoals. They are common along the east coast, while some of the largest fisheries are in the Solent, the mouth of the Thames, and off Margate. Off Folkestone, in January, 1879, the sea appeared alive with them, and they were sold at 1¼*d.* a thousand.

n the British Channel, or rather on the southern shores

wall, it is rare; on the northern coast it is more common. On the west coast of England it is occasionally abundant, but not to so great an extent as on the east coast. (See Migrations.)

In Ireland it has been recorded round the coast, but there is no sprat fishery off the counties of Antrim or Down, still they are taken in large quantities along the south coast.

Three are mentioned as sent to London from Aldborough over 6½ inches in length. (*Field*, January 21st, 1882.)

4. Allice-shad (*Clupea alosa*).

The *allice-shad*, *alewife*, *king of the herrings*, *daming herring*, *rock herring*.

B. viii., D. 19–21, P. 15–16, V. 9–10, A. 20–24, C. 20, L. l. 70–80.

Length of head 5½; height of body 4 to 5 in the total length. *Eyes.*—With adipose lids, diameter 5½ in the length of the head, and from ⅔ to 1 diameter apart. Lower jaw slightly prominent, with a notch at the centre of the upper jaw; cleft of mouth oblique; the posterior extremity of the upper jaw reaches to beneath the hind edge of the orbit. *Teeth.*—Minute in the jaws, absent from the palate and tongue; gill-rakers on the lower branch of the outer branchial arch, long, thin, and numerous, from 60 to 80 in number; but Canestrini and Moreau have pointed out that the numbers increase with the age of the fish. *Fins.*—The dorsal commences nearer to the end of the snout than to the base of the caudal fin; ventrals small and inserted slightly behind the origin of the dorsal. *Scales.*—15 to 17 strongly carinated ones along the abdominal edge, posterior to the insertion of the ventral fin; fine ones extended over much of the caudal fin.—*Colours.*—Back, greenish-blue; sides, silvery, dashed with purple and gold: occasionally one, sometimes two, dark shoulder spots, while a succession of several more along the side has been recorded, but these are more commonly seen in the young.

Habits.—A marine form which enters rivers for breeding purposes, when it ascends in shoals, but in the sea appears to lead a more solitary existence. It is shy and timid, and has been reputed to take pleasure in music, but should it thunder while ascending rivers, an immediate return to the sea occurs. In the Severn and Wye it is looked for in April and May, but does not appear to ascend very high. McIntosh found in the stomach of a large example captured in the Tay, *Confervæ, Desmids* and a quantity of vegetable *débris.*

Means of capture.—Mostly netting, while Couch records its having been taken in a trammel. It is occasionally captured along the south-east coast, when whiffing for pollack, the bait being a slice from a mackerel or a sand-eel.

Breeding.—It enters our rivers from May until the middle of June for breeding purposes, during which period it appears to cease from feeding.

As food.—It is rich and highly esteemed, were it not for its numerous bones; the higher it ascends the rivers the more its quality improves, whereas those from the sea are somewhat coarse and inferior. It commences being in the markets in considerable numbers about April, and large quantities are imported from Holland.

Habitat.—Coasts of Europe, entering rivers. It has been recorded from Banff (Edward), where it is said to be rare; Aberdeen (Sim); not uncommon at St. Andrews (McIntosh); in the Firth of Forth (Parnell); Berwickshire (Johnston);

Yorkshire (Yorkshire Vertebrata); not uncommon along with the herrings (Paget). Yarrell obtained an example in 1831, captured above Putney Bridge; and Jesse recorded another, full of spawn, taken at the end of June, opposite Hampton Court Palace. It is also taken along the south coast, and has been recorded from Mount's Bay and St. Ives in Cornwall. It used to abound in the lower portions of the Severn and the Wye, but is not so abundant as it used to be.

In Ireland it is found on the north-east coast, and by no means uncommon on the west coast; it is often abundant in Limerick Harbour, and Brandon Creek on the coast of Kerry. In the Ordnance Survey it is said not to be uncommon off Derry.

This is by far the larger of the two British species of shad. Buckland mentions one of 5½ lb. weight he received from the Tay; and Couch remarks that it attains to 4 feet in length.

5. Twait-shad (*Clupea finta*).

Names.—The *twaite-shad*, *maid.*

B. viii., D. 18–20, V. 9, A. 20–25, L. l. 60–75, Vert. 55–56.

Length of head 5; height of body 5½ in the total length. *Eyes.*—With adipose lids; diameter 4½ to 5½ in the length of the head, and 2 diameters apart. Opercle with some raised and radiating striæ descending towards the subopercle. Upper jaw, with a median notch to receive the end of the somewhat prominent under jaw; the maxilla reaches to beneath the hind edge of the eye. *Teeth.*—Small and deciduous in the jaws, absent from the palate and the tongue; gill-rakers thick, osseous, and from 20 to 30 along the horizontal branch of the outer branchial arch. *Fins.*—Dorsal commences nearer to the end of the snout than to the base of the caudal fin; ventrals inserted on a line slightly behind the origin of the dorsal; anal fin, low; caudal, deeply forked. *Scales.*—15 to 17 carinated scales along the abdominal edge posterior to the base of the ventral fin; small ones over most of the caudal fin. *Colours.*—Steel blue along the back, becoming silvery along the sides and below; a large blackish blotch on the shoulder, generally succeeded by five or six more along the upper third of the side of the body.

Habits.—This anadromous fish ascends some of our largest rivers, as the Severn, the Wye, and formerly the Thames, at the end of May or commencement of June for the purpose of depositing its ova in fresh water. Formerly they went up the Severn to far above Shrewsbury, but, since about 1846, they have been stopped by a weir. They usually return to the sea by the end of July.

Means of capture.—Yarrell observes that in the Thames great numbers used to be taken every season, especially opposite Millbank Penitentiary, Westminster, also above Putney Bridge; but the state of the water has caused a more or less complete cessation of their visits. Formerly their captures in the Thames were prohibited after June 30th, in order that the spawners might breed in security.

Baits.—Whiffing with a slice of mackerel has been found successful at the mouth of the Dart (Holdsworth). They are eccentric in taking a bait, are sometimes hooked at almost every cast, while at another time they will play round the lure, but will not touch it.

Breeding.—In June and July. Fishermen on the Severn believe they spawn on the sands: the young are seen in great abundance in the shallows and easy waters at or near the close of the season, should the weather be warm. Yarrell observed that about the second week in July used to be when they spawned in the Thames. They appeared to disencumber themselves of their roe by violent muscular action, and on a calm still evening or night the noise they make might be heard at some distance. He obtained the young 2½ inches long in October, and only 4 inches long the following spring.

As food.—Owing to their numerous bones it is not held in much estimation in our markets; the flesh also is rather dry.

Habitat.—Scandinavia and the coasts of Europe, entering rivers for breeding purposes. It is taken in the Mediterranean, and as far as the Nile.

Banff, rare (Edward); Aberdeen (Sim); in the Firth of Forth at the end of July, disappearing in August (Parnell); Cumberland (Heysham); off Yorkshire (Yorkshire Vertebrata); Yarmouth, not uncommon (Paget); mouth of the Thames, and along the south coast as far as Cornwall.

In Ireland it annually ascends some of the southern rivers. Ruttey mentions it as having been found in the Liffey near Ringsend; while in Tighes, Kilkenny, the shad is recorded as ascending the river. Early in May, Dr. Ball states, they were taken abundantly in the Blackwater at Cappoquin, where the water is brackish. They are called *long horsemen*, and, not being esteemed, are sold for one penny each—even the largest, which reach twenty inches. Andrews says they are common in the northern rivers; they have been recorded from Belfast Bay; Newcastle, co. Down; Youghal; the counties of Cork, Galway and Dublin; while Thompson says two or three were taken in Donegal while he was there.

It attains, according to Yarrell, about 16 inches in length.

II.—FAMILY OF EELS (*Murænidæ*).

1. Conger (*Conger vulgaris*).

Names.—Haaf-eel, cungyr or *kunger, Mor Lysowen*, and *Cyngyren*, Welsh.

Eel-shaped. Cleft of mouth deep, reaching to beneath the eyes; jaws even in front. Eyes of moderate size. Anterior nostril tubular; the posterior opposite the antero-supero angle of the eye. *Teeth.*—In the maxilla and mandible, in several rows, one of which are so placed as to give a single cutting edge; canines absent; vomerine teeth extend backwards almost to the end of the tongue. *Fins.*—The dorsal commences above the end of the pectoral, is well developed, and, as well as the anal, is continuous with the caudal. Pectoral more than half the length of the head. *Colours.*—Superiorly pale brown, becoming lighter on the sides, and white beneath. Dorsal and anal fins margined with black.

Varieties.—Thompson mentions a dark-coloured form, which frequents rocky ground, and does not average above half the weight of those taken on soft ground. Generally the colour varies with the ground on which it resides. In 1876, one of about 20 lb. weight, of a lead colour approaching to white, was brought in from the deep sea and placed in a large wicker basket in the sea close to land. In six weeks it was as black as it possibly could be. In some there is a deficiency of the upper jaw or snout; the dorsal fin is frequently deformed, the anterior portion being deficient or malformed, or it may be almost absent as far as the tail. Occasionally, due to some accident or violence, the tail is found to terminate abruptly without any fin.

Habits.—The conger prefers deep water, as up to about fifty fathoms, where there is a rocky bottom, or sandy patches, surrounded by rocks, which are covered with weed. It is extremely voracious, preying on other fish, or even its own kind, or crustacea, especially at the time they have lost their shells, and are consequently in a soft condition. It and the common eel are also particularly partial to carcases of any kind, being frequently found in such as have been accidentally brought to the surface. Although it appears to frequent favourite haunts from which it does not stray any long distance, still it is more common at some times than it is at others. It appears to be sensitive to atmospheric changes, being inert during the cold weather, and more than usually active just before a storm. It seems to be more readily captured at night-time, especially if dark, while during its migrations it does not seem to have been taken in fresh waters. If in a boat, it feels about with its tail, by which it fixes itself to some object, and then throws itself overboard; consequently, as soon as captured it is generally knocked on the head. Muscular energy still exists in the heads of these fish for some period after they are apparently dead; thus a person placing his foot inside the mouth of a seemingly dead conger has had his shoe drawn off. Many instances are also on record of the decapitated heads of these fish closing upon foreign bodies being inserted between their jaws, as on attempting to remove a hook from the mouth of one; and Patterson relates how a boy, seeing the head of one on the shore, just left by the fishermen, stuck his toe into its mouth, and his yells soon brought assistance.

Its digestion is very rapid, and it will not only take fish off hooks, but likewise tear them out of nets, and find its way into lobster-pots in order to eat the prey contained therein. Templeton observes that a vessel loaded with salt herrings was wrecked off the coast of Rathlin: congers gorged themselves, and great numbers died and were washed ashore for several days after this unlucky feast. In the Moray Firth fishermen assert that they are fond of swimming after newly tarred boats. Off the coast of Cornwall a number of congers were opened for the purpose of ascertaining upon what they had been feeding, and the following contents were observed in their stomachs:—wrasses, skulpin, pollack, one-spotted gobies, a father-lasher, lesser forkbeard, sand-launce, pilchards, pipe-fishes, small congers, rocklings, hake, octopus, many forms of crabs, shells, especially whelks, and other animal substances.

Means of capture.—Hooks and lines, either used by the hand, or long lines, with hooks at regular intervals. They are very destructive to nets, and can bite through a rope as thick as a finger. If hooked they twist round and round, and will wrench the hook from out of their jaws. The sand-launce is among the best of baits for these fishes, while it refuses any bait that is not quite or moderately fresh.

Breeding.—Generally in December and January. It is remarkable that although many examples have been kept in aquaria, the females appear almost invariably to die, due to being unable to extrude their ova. This would seem to be consequent upon want of facilities for depositing the eggs, as in some fishes pressure appears to be necessary. As many as 6,336,512 eggs have been observed in one fish. At the Southport Aquarium congers have been observed to increase from 7 lb. or 8 lb. weight to 25 lb. to 30 lb.

Uses.—The method in which congers used to be cured was by splitting them, then hanging them on a frame until dry; and the fat should exude before they are fit for use.

As food.—Congers have been differently esteemed at various periods. In England, as early as the fourteenth century, it was a highly prized article of food, while the milt and roe were employed in select cookery. Before these fish decreased off our shores, and the foreign purchasers of salted congers in Spain fell off, a considerable trade in these fishes was carried on. Now they are largely employed as stock for soups, and most of the stock at hotels for public dinner turtle-soup is made from congers. A considerable quantity are likewise tinned and exported. Dried and grated, dried or salted conger is employed as a flavour for soups. In many parts of Scotland these fish are rejected, but at Edinburgh they meet with a ready sale. In some places congers have to be furnished as a heriot.

Sudden cold is often very destructive to these fishes. They get what is termed "blown;" their air-bladder expands, and they float at the surface of the water. In this state they are helpless, readily killed, and may be thrown on shore or left dead by the tides. Otters in the Orkneys bring them on shore, but eat a very small part, leaving the rest for the new-comer; and where its haunts are known the country people are very careful every morning to search for the remains, which are often seen among the deep hollows of the rocks. A conger 35 lbs. weight, when being pursued by a porpoise, ran ashore for several yards up the beach at Colwyn Bay, and was gaffed.

Habitat.—All round our coasts, and especially abundant along the south coast. On the Irish coast it is most sought for during May and June.

Borlase mentions one taken in Mount's Bay of 100 lb. weight; in 1879 one 128 lb., and 8 feet 3 inches in length, was received in the London market; one of 112 lb. was taken by Mr. Dunn at Mevagissey; and Yarrell mentions one of 130 lb.

SUB-CLASS II.*—CARTILAGINOUS FISHES, OR CHONDROPTERYGII.

ORDER I.—PLAGIOSTOMATA.

FAMILY I.—SHARKS, or *Carchariidæ.*

The true sharks can hardly be included among the commercial fishes of the British Isles, as their products are but rarely brought into the market. They are more known and dreaded on account of the injuries they inflict on the fishing interests, by robbing the fishing lines, tearing fish out of the nets, becoming entangled themselves in the nets in which they frequently roll themselves, so as to utterly destroy their subsequent utility. The only uses to which they appear to be put is, in the extraction of oil from their livers when their size is sufficiently large and the appliances are at hand, and their employment as manure.

FAMILY II.—DOG-FISHES, or *Scylliidæ.*

1. Lesser Spotted Dog-fish (*Scyllium canicula*).

Names.—Spotted and *lesser-spotted dog-fish*, *row-hound*, *morghi*, *small spotted dog*, and *Daw-fish* in the Orkneys.

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* Professor Huxley, on anatomical grounds, has come to the conclusion that the separation of Elasmobranchs, Ganoids, and Dipnoids into groups, apart from and equivalent in rank to Teleostei, is incon- nt with facts—a subject unsuited to discussion in this place. the generally adopted classification has been adhered to.

In this species the nasal valves are confluent, and form a broad flap across the mouth, which is not interrupted in the middle, neither is it furnished with a barbel. There is no labial fold to the upper jaw, but one laterally at the mandible. *Teeth.*—With a central projecting triangular cusp, and a short but similar lateral one on either side. They are of medium size and in several rows. *Fins.*—Two dorsals, the first behind the ventrals, which latter are rather large. Anal situated beneath the interspace between the two dorsal fins. *Colours.*—Reddish-brown, with the back and upper two-thirds of the body and head covered with numerous and small reddish-brown, olive, or dark spots, some of which, but of a larger size, being extended on to the various fins. Lower surface grey or white.

Habits.—A migratory species, which appears to remain at the Orkneys later into the cold months than some of the other forms.

Uses.—Of little value either for food or oil. Is said to be eaten at Roundstone in Ireland, and also in the Isle of Man. In the west of Cornwall it is employed in the preparation of "Morghi soup," which is there valued; likewise in Devonshire it is sometimes used as food. Lacépède states that the use of it is not without danger, he having known a family almost poisoned who had partaken of it. At the Island Magee in Ireland it is employed as bait in the "buckie" creels to capture shell-fish, *Buccinum undatum.*

Habitat.—Coasts of Europe. It is taken in great quantities in the Orkneys, and is common all around our shores and in Ireland.

1. Picked Dog-fish (*Acanthias vulgaris*).

Names.—Piked, or *spiked dog-fish ; common dog-fish ; spur* or *bone-dog*. *Hoe* (in Orkneys). *Skittle-dog* (male in Cornwall).

Snout produced ; mouth slightly arched, with an oblique groove on each side. *Teeth.*—In both jaws small ; with their points turned so much on one side that their edges become their cutting surfaces. *Fins.*—Each dorsal fin furnished with a spine in its anterior portion, while the origin of the first dorsal is placed above the interspace between the pectoral and ventral fins. Anal fin absent. *Colours.*—Superiorly of a slate-grey, while inferiorly it is yellowish-white. Young examples have white spots along the back and upper half of the body. Skin rough on the hand being passed from behind forwards.

Habits.—A gregarious fish, which ranges through our seas in search of prey ; occurring in the Orkneys in such shoals that the fishermen have been known to load their boats to the water-edge with them. So numerous are they along our south coast that 20,000 have been taken in a seine at one time. When captured it writhes itself across the fisherman's hands, and if they are not attentive it wounds them severely, and often dangerously. Yarrell alludes to a school of these fish in 1858 which extended in an unbroken phalanx on the east coast of Scotland for 20 to 30 miles. At the end of 1882 they were so numerous off the Cornwall coast, as to impede, and in some instances stop, the pilchard fisheries, owing to the injuries they occasioned to the nets.

Uses.—Oil is made from the liver of this fish, its refuse is useful for manure, and its rough skin used to be employed for polishing wood.

As food.—It is in places dried and also salted, and though rather strongly tasted, is largely used as food in the Hebrides, where it is sold as "Darwin salmon." It is prepared by being cut open and dried, while it is so full of oil that it does not decompose. In the West of England, both fresh and salted, it is a very common article of food with the fishermen.

Habitat.—Coasts of Europe, and much dreaded by fishermen for the injury it occasions fisheries, not only by the amount it consumes, but because of the loss it occasions in fishing gear. Faxby observes ('Zoologist,' 1871, p. 2553) that at Newfoundland during the last few years it was thought to have been "cursed away."

FAMILY III.—*Raiidæ.*

Rays and skates are largely taken around our coasts, and the young are destroyed in numbers by trawlers when of a size too small to be useful as food. It seems possible that in olden times these fish were not much employed, as the Anglo-Saxon word *skitan*, or to reject, is asserted to be the origin of our term "skate." Other authors derive the name from *sceadda*, or gliding. The peasantry of Western Ireland refuse to eat it, however plentiful it may be and however famished they are. It has been suggested that this superstition arises from the resemblance which this fish with its depending fins bears to the human face, and possibly to mediæval representations of the Virgin Mary.

These fish, from the nature of their skins, which continue to exude mucus for some days after death, do not take salt well, and are consequently dried by being hung up in the air; this "sour skate" is universally used in the Highlands and in the Isles, forming a favourite article of diet. Shagreen may be prepared from the skin of some of these fishes, or from that of a shark, but it is now artificially manufactured from the skin of an ass or horse scraped thin, and into which seeds are beaten. It is a long process, carried on at Astrachan.

1. The Skate (*Raia batis*).

Names.—*Blue*, or *grey skate*, Scotland. *Flair*, *tinker dinnan*, or *blunt-nosed dinnan*, Aberdeen. *Flanie* and *skider*, Northumberland.

Snout pointed and produced; interorbital space equals in width about one-third of the length of the snout. Mouth transverse, and in nearly a straight line. *Teeth.*—Pointed; over fifty rows in the upper jaw. *Fins.*—The outer angle of the pectoral is produced, and more or less pointed. Body rough in large females, but in the males nearly smooth. Some spines in the vicinity of the orbits, especially in the young, and two or three spinate rows along the tail. *Colours.*—Greyish-brown along the upper surface, with a reddish tinge along the edges of the fins, under surface of a dull or dirty white.

Habits.—The skate is a resident at the bottom of the sea, usually in soft and muddy ground at some distance from land, while it is very difficult to bring to the surface even after it has been hooked. It will entangle the line in any projecting piece of rock, or fix itself to the bottom like a sucker, and can only be removed by first elevating its head, and thus permitting water to get beneath its body. Even when hauling it into the boat care has to be taken to keep its head well up, for if it can manage to depress it, down it goes to the bottom, where it again fixes itself as before. It is very tenacious of life. It is rather choice in its food, having a special liking for whiting. Couch found in one a fishing frog (*Lophius*) weighing 6 lb.; in another a large plaice, a lobster, a mackerel, a thornback ray measuring upwards of 18 inches in length, and half a salmon, which appeared quite fresh, as if but lately swallowed.

Uses.—They are sold in large quantities in London, and among the poorer classes. Many are disposed of as bait for crab and lobster pots, for which they are well adapted. The liver affords good oil.

As food.—If large they are coarse, but their value depends very much upon the cook and the resources at his or her command. Small ones, termed "maids," are excellent.

Habitat.—All around our coasts, as well as those of Europe. Also in Ireland common, but less so to the north.

This fish attains to a very large size. In March, 1849, one was taken in Ireland, 7 feet 3 inches long from the nose to the tail, and weighing 224 lb. On December 23rd, 1881, another was captured in Donegal Bay something more than 7 feet long from the nose to the tip of its tail. In 1878 two were taken in North Harris, the one weighing 165 lb., the other 175 lb.; both were upwards of 7 feet in length.

2. The Thornback (*Raia clavata*).

Names.—Thornback ray; ray maid. Morcath bigog, Welsh.

Snout somewhat rounded, scarcely produced. *Teeth.*—Rather large, the central ones conically pointed in the males, while they are flat in the females. *Fins.*—Outer angle of pectoral fin somewhat pointed. Body with numerous spiny elevations, which are well pronounced in the supraorbital region, and a row likewise exists along the back. *Colours.*—Brownish, superiorly covered with numerous light-coloured spots, and occasionally a large one on each pectoral. Under surface white.

Habits.—The thornback is found in shallower waters than most of the family, and is taken all through the year. Lowe observes that off the Orkneys they are frequently met with in the eddies of the tides, or where two tides meet; especially when the tides run strong they are obliged to withdraw to these calmer spots, their shape hindering them from sustaining themselves against the force of a strong current. These fish have been observed to glut themselves with scad (*Caranx trachurus*).

Means of capture.—Trawls and baited hooks; they are partial to herrings, pilchards, and crabs and other crustacea.

As food.—It is good eating when not too large, but as in all members of this family it becomes coarse with age. In Ireland it is the form least objected to, but only the young or half-grown are employed as food. In Scotland they are mostly prepared under heavy pressure, as already alluded to. In many places the livers are removed for the purpose of extracting the oil, which is said to be much used by shoemakers in the preparation of cobbler's wax; also fish-liver oil is exceedingly useful as an adjunct to the paint of boats. Further remarks on the rays and skates appear to be scarcely necessary. This species is taken all round our coasts.

SUB-CLASS III. -CYCLOSTOMATA.

FAMILY I.—LAMPREYS (*Petromyzontidæ*).

1. The Sea-lamprey (*Petromyzon marinus*).

Names. — *Lampreda*, Anglo-Saxon. *Lamprey*, from "lambere," to lick, and "petra," a stone. In some places termed a "sucking-fish." *Nine-eyes* and *seven-holes*. *Llysowen bendoll* and *Llamprai*, Welsh.

Of an eel-shaped form, with in the adult a circular mouth (hence the name of the sub-class), destitute of true jaws, and capable of being employed as a sucker. The body is long, cylindrical, and somewhat compressed posteriorly. *Teeth.*—The mouth, which is sub-inferior and surrounded by a circular lip, has maxillary, mandibular, suctorial and lingual teeth, all of which are of a horny consistence, and a more or less conical shape. At the centre of the top of the head is the external opening of the nasal canal, which terminates inferiorly without perforating the palate. The gills are in the form of fixed sacs, seven on either side, and which are not furnished with branchial arches. They open along either side of the neck by seven rounded orifices. Internally these sacs open into a common tube, which inferiorly is closed, but superiorly communicates with the mouth. Respiration is carried on in these sacs, which can either receive water by way of the mouth, or directly should the mouth being employed as a sucker, render taking in water there impossible. *Fins.*—Two dorsal fins, the posterior being continuous with the caudal. Skin, smooth, and rather tough. No air-bladder. Intestinal canal straight, and possessing a spiral valve. Skeleton cartilaginous and notochordal; no ribs; skull not separated from the vertebral column. *Colours.*—Of a greyish or olive-brown, blotched along the back with black marking, which become irregular; blotches and spots along the upper two-thirds of the sides.

Müller, in 1856, showed that these fishes are subject to a metamorphosis, the genus *Ammocœtes* being in reality its larval form, while it requires at least 3 or 4 years in the small pride, *Petromyzon branchialis*, for its complete development. In the larva the mouth is not circular, while the lower lip is placed far back and covered by the upper, which resembles a hood. No teeth of any kind are present, but merely moss-like papillæ, or barbels, under the upper lip.

Habits.—An anadromous fish, which ascends rivers to breed, in the Severn as early as the middle of March. Its circular mouth forms an expanded disc, and by an exhaustive action air and water are removed, and thus a vacuum is produced; the fish can then attach itself to any fixed object, and no muscular action is necessary to prevent its being carried down stream by the current. In the same way they adhere to their victims, eat into their substance, and thus manage to tear away and swallow mouthfuls of mashed-up meat. Fish have been captured which have undergone this torture, but yet have recovered the injury. About 1878 an individual, when bathing at Margate, was alarmed by one of these fish, about 18 inches in length, fixing itself on him while he was bathing; and so tenacious was its hold, that the bather brought it out of the water attached to his body. These fish are frequently captured at sea, and often at some considerable distance from shore, but they are generally of rather a small size. This is one of the forms of fishes which has been said to lay hold of ships so firmly as to be with difficulty detached; it and the remora have both in this country been termed "sucking fishes." Sailors have asserted that they attach themselves to vessels in order to feast on the tar. Lampreys have been known to attack gurnard, mackerel, coal-fish, cod, and haddock.

Means of capture.—The date at which this fishery commences in the Severn is rather uncertain, but is generally considered to be from February until May. At the end of March, 1881, although a few had been taken, the fishery had not regularly began at Tewkesbury. Sometimes they are taken as late as the end of June or even in July, but they are out of season. They are often netted along with salmon and shad, but are usually obtained in weels laid at the bottom of the river, while they are mostly fished for at night. Those taken in wicker traps are considered more valuable than such as are captured in nets, as they do not roll themselves about so much, and consequently are less bruised. On warm, sunny days, a person may be punted very quietly to over where these fishes are nesting, when they may be easily gaffed or speared.

Breeding.—At each breeding-place they are generally seen in pairs, commencing about the month of May; and they form a furrow at the bed of the river for the reception of the ova, for which purpose they remove any stones which may be in their way, and this is effected by their attaching themselves to it by means of their suctorial mouth. Pennant says that one fish weighing 3 lb. was taken in the Esk adhering to a stone of 12 lb. weight suspended at its mouth, and from which it was forced with no small pains. Breeding over, they rapidly go out of condition and descend to the sea.

As food.—Lampreys have been held in very different estimation at various periods of our history. Henry I. is said to have died due to having made too plentiful a meal on potted lampreys; Henry IV. granted protection to such ships as brought over lampreys for the table of his consort, while his successor issued a warrant to William of Nantes to supply him and his army with lampreys whensoever they should happen to march.

The Earl of Chester sent a single lamprey to King John, who in return sent him a good palfrey. The city of Gloucester formerly presented the reigning sovereign with a dish of lampreys annually, and a lamprey pie to the Prince of Wales.

Their best season is when they first arrive from the sea, as March, April and May, as after breeding they rapidly deteriorate, becoming flabby and emaciated. They are a great delicacy potted or stewed, but a surfeiting food. In the Severn they are commonly said to attain their greatest perfection by "Ascension Day," subsequently to which they fall off. The vertebral column, or back-bone, should be entirely removed before these fish are cooked; some even consider it to be poisonous.

In the Forth, above Alloa in Scotland, Parnell observes they are returned to the water by the fishermen, who have a prejudice against them. In Cornwall, we are told, they are only used as bait, while in Ireland they are rejected because they are so ugly.

Habitat.—Found around our coasts, ascending rivers at their breeding period; they have been noted from the north of Scotland down the east coast to England, being not uncommon in Yorkshire, and abundant in the Yare, in Norfolk, in April and May. A few yearly pass up the Thames, while they are comparatively common along the south coast, but becoming rare in Cornwall. The Severn, however, is the most noted British river for these fish. In Ireland it is found all round the coast. In the larger rivers connected with Lough Neagh, it is of regular occurrence, ascending the Ballinderry not only as far as Coagh, about five miles from Lough Neagh, but four or five miles further.

It is usually from 20 to 28 inches in length, but has been captured at Gloucester up to 39 inches.

2. Lampern. (*Petromyzon fluviatilis.*)

Names. — *Lampern*; *lamper-eel*; *seven-eyes*; *nine-eyes*; *nine-holes*; *barling*, *cunning*, and *spanker-eel*

orthumberland); *Say - nay* (Lancashire); *Lleppog*
Velsh).

Of a shape similar to the lamprey, but rather more com-
essed posteriorly; mouth circular; a single transverse
axillary tooth, having a cusp at either end; a single
ansverse mandibular tooth, with about seven cusps; small
eth on the disc, and which are few in number; tongue,
ith a broad transverse tooth, having a median cusp; two
three teeth on either side of the gullet, which may have
o or three cusps; gills as in the lamprey. *Fins.*—Two
rsals separated by an interspace, the posterior fin con-
nuous with the caudal. *Colours.*—Silvery white, darkest
ong the back.

Habits.—Yarrell considered that this species is entirely
esh water, as he found no difficulty in obtaining examples
y month of the year from the Thames. Very few ascend
ove the navigation weirs in the Thames or on the Severn,
hile they deteriorate in value the higher they go. For-
erly they reached Montgomeryshire, and are said to have
en taken in the Verniew. In the Severn they commence
pturing them near Tewkesbury in September, and the
ason generally terminates by the end of March; they sell
r about 1*s.* 6*d.* a score, and are largely purchased both
r bait and potting. Thompson received one which was
ptured adhering to a large trout, and continues: "In
large, deep pond, made for gold-fish, at the falls near
elfast, a portion of the surface of which was covered with
e leaves of the white water-lily, I observed, on a warm
ay in summer, an extraordinary appearance, caused, as I
elieved, by this species. To the under surface of each
oating leaf of the plant several (in some instances as many
s a dozen) lampreys, about a foot in length, the adult size
f this species, attached themselves by the mouth, while

the wriggling of their dangling bodies had a strange effect. They were too far from the edge to be captured by any available means, but I have no doubt that they were all full-grown individuals of this species." It consumes water-insects and the flesh of dead fish, while itself falls a victim to a large extent to rats, which prefer the breathing-hole to any other portion of the fish.

Means of capture.—They used to be taken in enormous numbers in the Thames from Battersea Reach to Taplow Mills. Now they are detained and caught at the Teddington Weir in a sort of basin, being unable to reach their spawning beds. In 1882 it was stated that 120,000 had been taken in the Thames up to the middle of January, and they still kept coming. As they decrease in numbers, their price rises for the Dutch market, where they are required for the turbot and cod fishermen, and as many as 400,000 have been supplied in one season from the Thames at 40s. a thousand, but which have now risen to 100s. a thousand. They are very tenacious of life, and are kept alive for some weeks at sea. They are generally taken in wicker traps.

Baits.—Dame Juliana Berners observes, when recommending a worm or a minnow for trout, "in Aprill take the same baytes; and also Juneba, otherwise vii eyes."

Breeding.—Yarrell examined some from the Thames every week from March until the middle of May, and with the following results. To April 19th the females exceeded the males in number; subsequently the females became nearly ready to spawn, when he found the proportion to be two males to one female. By the 26th of April all the females were ready to spawn, and the milt from the males readily exuded. By May 10th all were shotten. A correspondent of Loudon (Mag. Nat. Hist., vol. v.) observed that when breeding, one twists its tail around another, during which time the sand and gravel were stirred up; these two fish, it was remarked, were invariably of the opposite sexes.* Yarrell found that, although when breeding they may be found in pairs, such is not invariably the case, as often a number act together, and remove all the stones which impede their spawning operations.

As food.—The lampern is milder than the lamprey, and those taken in the Severn at Tewkesbury are largely purchased for potting, care having been taken to remove the backbone. At the end of January, 1882, they realised at Worcester about £4 a thousand. Many are also sold as bait for the cod fisheries, and in March were being sold at 50*s.* a 1000. The Dutch for centuries have visited the Ouse to purchase these fish as bait for their turbot and cod fisheries. In Norfolk a prejudice prevents their being eaten, unless by a few of the initiated; they are consequently thrown away.

Habitat.—Abounds in many rivers in England, particularly the Thames, Severn, and Dee; also in the Tweed and several Scottish rivers. Numbers are taken in Yorkshire, and a good many in Norfolk, where it is sold to the eel-fishers as bait, for which purpose it is excellent, cut into pieces about an inch in length, while it is so tough when on the hook as to baffle any attempt of the eel to suck or nibble it off. It will last good for two or three nights' trial, while roach and small fish become sodden. It is chiefly found in the gravelly shoals towards Trowse

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* In Norfolk, in 1882, a gentleman observed some small lampreys (*P. branchialis*) during the breeding season. Two fish, each of different sexes, fixed themselves securely to a stone by their sucking mouths, and then twisted themselves one round the other. In this position they rapidly pulled themselves backwards and forwards, a proceeding which would naturally assist in expelling eggs or milt.

Bridge, near Norwich, during May and June, and is abundant in the Yare in April and May. Large quantities are taken in the Trent for bait, the fishing commencing at the end of August and continuing until March. They are sent to Great Grimsby in wicker baskets, and Buckland observes that it is considered necessary to have a man with them who keeps constantly stirring them up. I have already alluded to this fish being taken in the Thames, and may in continuation observe that in March, 1867, in that river below Surley Hall, five or six lampreys were found in eel-pots which had remained in the river all the winter; fishermen asserted they had not seen any there for the preceding ten years. In the Exe, Plym, and Axe they are sometimes abundant, and are likewise common in the eastern part of Cornwall, especially in the spring.

In Ireland they are found from the north to the south, sometimes adhering to other fishes and devouring them.

They attain to 10 or 15 inches in length.

THE EFFECT OF THE EXISTING
NATIONAL AND INTERNATIONAL LAWS
FOR THE
REGULATION AND PROTECTION
OF
DEEP SEA FISHERIES
WITH
SUGGESTIONS FOR IMPROVEMENTS IN SAID LAWS

"*EXPERIENTIA DOCET.*"—By C. W. MORRIS

INTRODUCTION.

THIS essay has been written with the object of showing, amongst other things,

The great differences which exist in the prosecution of the Deep Sea Fisheries, arising either from the nature of the locality or the class of fishing.

The consequent great difficulty of successfully legislating so as to promote their prosperity under one law for all localities and classes.

The utter impossibility of such legislation being framed satisfactorily by a Government department unacquainted with these various localities and classes and the industry generally, and not having practical men as its advisers.

To prove the above it has been found necessary to criticise rather severely in some cases the past and present legislation which has emanated from the Board of Trade through its officers, but it must be clearly borne in mind that such criticism is not intended to be invidious in any way, as there can be no doubt that the department has had, and still has, a very difficult task before it, which it has endeavoured to perform to the best of its power, considering the means at its disposal.

INTERNATIONAL LAWS

FOR THE

EGULATION AND PROTECTION OF DEEP SEA FISHERIES.

Mode of procedure

treating of this most important subject the best plan pursue will be to discuss the whole question *seriatim*, aling first with the former part of the subject given, viz., e effect of the present laws, and then concluding with me suggestions for their improvement.

For the purpose of thoroughly going into the question d dealing with it in such a manner that those who are acquainted with our fisheries may not be drawn into ysteries, a brief but general sketch of the various deep a fishings round our coasts, the craft and nets employed carrying them on, and the fish caught on various coasts various seasons, will be useful.

Scotland. East coast.

The principal fishery prosecuted on the east coast of otland is the herring fishery, by means of drift-nets. ext comes the long-line fishery, for cod, ling, hake and ddocks; and lastly, trawling, which at present is in its fancy as regards Scotland.

The herring fishery is prosecuted principally by means sailing craft, lug-rigged, the size of which varies up to out fifty feet in length. Steam for this purpose is as yet its infancy. As a rule the business is conducted on the co-operative principle. One man will probably provide the boat, and every other man of the crew so many nets each, according to the size of the boat. Thus each man has a direct interest in the prosperity of the voyage in every way, and perseverance and care of gear are encouraged.

The same principle is introduced into the line fishing. The trawling on this coast is principally prosecuted at present by steam tugs from the north country ports, whose legitimate calling is not now so lucrative as formerly, owing to the decrease of the number of sailing ships and the increase of steamers. The herring fishing is followed up by these Scotch boats at various ports as high as Yarmouth and Lowestoft, so that it is possible for a Scotch boat to commence to catch herrings at Ballantrae or the north of Scotland in January, and continue the various fishings from thence to Yarmouth or Lowestoft in November or December.

Shields to Scarborough.

The next fisheries will be those from what may be termed the northern coal ports, viz., Shields, Sunderland, Hartlepool, Whitby and Scarborough. Here, again, the herring fishery is the most important, and is carried on by large cobles and boats similar to the Scotch boats. Here appears to commence the breaking up of the Scotch co-operative system. Some boats sail on this latter principle, others are owned (including gear) by one man, the crews simply receiving a share for their labour. Long-lining and trawling is carried on at present chiefly by sailing vessels, but steam trawlers are on the increase in this district.

Hull and Grimsby.

Then come the important fishing ports of Hull and Grimsby, where the principal fishings are lining, trawling and whelking.

These are carried on principally on the share system, in most cases the master being the only one of the crew who as a pecuniary interest in the vessel or gear. The vessels e cutter and dandy rigged. At these ports the system of pprenticeships and the mortgaging of vessels may be said commence.

Yarmouth.

At the port of Yarmouth the herring fishery has been of nmense importance for many years past. Of late years awling has made tremendous progress, and may be almost aid to vie with the herring fishery for the supremacy.

This branch of the fisheries is prosecuted the whole ear round by fine smacks specially built for trawling. These are largely supplemented every year at the close f the autumn herring voyage by the largest of the rift-boats, which are then fitted out for, and continue rawling till the season for commencing the herring fishery omes round again, which may here be roughly stated to commence in July. The herring boats then leave and go down to the North Sea to meet the shoals of herrings, which appear to travel from north to south and reach the Norfolk and Suffolk coasts late in September. What is known as the home-fishing voyage is then commenced. The vessels here are principally cutter and dandy rigged, the old lug-rig being now the exception. Apprenticeships are very exceptional at this port, which may be attributed in a great measure to the scarcity of boys, the demand being greater than the supply. In the season of the herring voyage, boys have been known to receive as much as 25*s*. per week, which has been paid by owners rather than have their vessels detained. Men, therefore, under these circumstances sometimes ship as boys. The mackerel fishing, which at one time was the Principal voyage of the year, is almost entirely abandoned, owing to these fish having apparently deserted the coast.

Lowestoft.

Lowestoft is the next port and is of more recent date, as the harbour is an artificial one. The fishery dates chiefly from its construction, and has rapidly grown to large proportions. The herring fishery here may be said to be the principal fishing, though trawling is carried on to a great extent, and is very much on the increase. Owners of trawling-smacks from Ramsgate and Brixham are continually coming to reside here, bringing their vessels with them, as the trawl fish are now followed farther north. These are the principal trawl owners of this port, and by them Apprentices. the system of apprenticeships has been introduced, as far as trawlers are concerned, an apprentice to the drift fishing being practically unknown, though it can hardly be accounted for, as many drift-boats are now at sea about nine months out of every year, and during the remaining three an apprentice might be usefully employed in ransacking old or setting up new nets, tarring warps, overhauling rigging, and many other ways, and thus become a thorough master of the trade; but it is estimated that two-thirds of the drift fishermen of the present day on this part of the coast would be unable to prepare their own gear even if the materials were found them. Some of the drift-boats here commence to fit out for the Plymouth mackerel voyage in January; for the Irish mackerel voyage and home spring herring voyage in February, March, and April, some choosing one voyage, some another.

In June the voyage for the midsummer or fat-gut herring begins. A mackerel voyage is prosecuted at the same time. As soon as the boats have finished the midsummer herring voyage, they leave for the northern coal ports, and there commence the great North Sea herring voyage, gradually working up with the shoals of herrings to Yarmouth and Lowestoft about September, when the home voyage begins, and continues till Christmas. The boats sail principally on the share system; the smacks, some by the week, some by share, poundage or otherwise. The rig of smacks is principally the dandy rig, of the boats lug, but the lug rig is gradually gaining ground again, though nearly abolished a few years back. This port is undoubtedly the principal port for drift fishing on the east coast of England.

Woodbridge.

The next port of registry is Woodbridge, but none of the fishing vessels registered there sail out of the port, but out of the Aldborough river, and are long-liners only. There are a few vessels also of the same description at Harwich.

Colchester.

To the port of Colchester belong a number of small cutters, which proceed in many cases a long way from home, either oyster-dredging or trawling. Many of these are laid up in the summer, as a great number of the crews leave the port to take berths in yachts from Cowes and district during the season.

London.

The port of London comes next, where Barking Creek may almost be said to be the head-quarters of the long-line and trawl fishery interest. The system of apprenticeships has been largely carried on for many years. The number of fishing vessels from this port has rather fallen off of late years. The rig of the vessels is principally cutter and dandy.

Ramsgate.

Ramsgate is a port of considerable magnitude as regards the fishing interest, but principally in respect to trawling. There are a great number of trawlers belonging to this port, but they fish principally in the North Sea, where they form a fleet of their own, and work in a similar manner to the fleets from Yarmouth, Lowestoft and Hull, which will be more fully explained hereafter. The system of apprenticeships is largely carried on at this port. The drift-boats do more in the mackerel than in the herring fishery.

The rig here is chiefly cutter and dandy for trawlers, lug for drifters.

Dover. There are about twenty trawlers belonging to the port of Dover. They work principally at the Ridge and the Varne. They are dandy rigged.

Rye. At the port of Rye there are about forty vessels, principally medium-sized drifters. They prosecute the herring and mackerel fisheries both at home and in the North Sea, and at Plymouth. They are lug-rigged. Rye Bay is a good trawling ground and much worked by vessels from ports on this coast.

Hastings. At Hastings there are some small drifters which work similarly to the Ryemen, but the boats are necessarily small as they have to work off the beach when at home, there being no harbour for them. They are lug-rigged.

Shoreham. There is a similar class of boats at Shoreham which also prosecute the North Sea, home, and westward mackerel and herring fisheries. These are also lug-rigged.

Dartmouth. Dartmouth for Brixham is the next port to be glanced at. It may be said to be entirely a trawling port. Of late years these vessels have had to proceed principally to the North Sea for fishing. This may be accounted for in two ways. Firstly, the better fishing to be got farther away from home; secondly, the great improvement in the vessels themselves, both in build and tonnage. They are principally cutter and dandy rigged. There are some apprentices here.

Plymouth. There is a fair number of vessels from Plymouth, but they are principally trawlers. What drifters there are, prosecute principally the mackerel and pilchard fisheries. Many of the trawlers work in the North Sea, though it is a long way from home. The system of apprenticeships is not much carried on here. The rig is chiefly cutter and dandy.

Penzance is the next port to be noticed. In contra-distinction to Ramsgate and Brixham, it may be said to be a port devoted to drift and seine fishing, trawling being the exception. The fishing is principally for mackerel and pilchards, though for some years past numbers of these boats have made it a practice to leave home in July, and go as far as the northern coal ports to prosecute the North Sea herring fishery, and return home again late in September. This number increases every year, and last year the number must have been between two and three hundred sail. This increase may be accounted for by the fact that the boats from this port in years past were not decked, being thus more handy for the pilchard voyage at home, which is prosecuted at about half a mile from the shore, and were consequently not fit for a long voyage. The boats of recent build are much improved in size, and many of the largest of the old boats have been decked. They are lug-rigged, but are peculiarly built, having a very light draught of water forward, and very deep aft. They carry in consequence unusually large mizens, which drive them ahead very fast, and cause them to sail very near to the wind. Apprentices are uncommon here, and there are a good many shore owners, though in some cases masters and mates have an interest. The crews usually sail by the share, the owners finding the boat and gear, and taking a proportionate share for them.

St. Ives. St. Ives is the next port; there are a good many boats here, similar in every respect to the Penzance boats just alluded to. They usually work on the same grounds as the Penzance men.

West coast. The ports on the West coast as far as the fisheries are concerned are not of much importance; they include Padstow, Bideford, Barnstaple, Bristol, Cardiff, Swansea, Milford, Cardigan, Carnarvon, Beaumaris. There are a few vessels at all these ports, but they are principally small trawlers which do not go very far away, and supply local wants only.

Liverpool.

Next to these is Liverpool, which has only a small fishing fleet when the size of the port is considered. They consist principally of trawlers which work in the Irish Sea. Fishing is a very dangerous occupation in this district owing to the immense traffic caused by the large number of steamers bound to and from this port.

Isle of Man.

The Isle of Man boasts of a large number of boats, which hail from Douglas, Ramsey and Peel. They are principally engaged in drift fishing, and work from Cape Clear along the eastern Irish coast up the western coast of Scotland in the various seasons of mackerel and herrings. The build of the boats is somewhat similar to that of the Cornish boats with duck sterns and lug-rig. Some crews work on the co-operative system, but there are a good many shore owners. Apprentices are the exception.

West coast of Scotland.

The ports of Western Scotland and those of the Hebrides come next in order. There is a good number of boats here, mostly of the same type as the boats of the east Scotch coast, which are worked on the same co-operative principle, and it would be merely a matter of repetition to say more than this. The mode of fishing here is somewhat different; in many cases it consists of herring catching by means of anchored nets reaching from the bottom to the surface of the water. These are set on the spawning banks and in the lochs, and are quite stationary.

Ireland.

The principal port in Ireland for fishing vessels is Dublin. Next come Cork, Belfast, Newry and Skibbereen. The other ports are represented by only a small number of vessels. Trawling and drifting are both practised, but it is a well-known fact that the Irish fisheries are not prosecuted as they might be. This is owing mainly to the want of ital and the conservative views of the fishermen. They not like English fishermen to go there and work as they on their own coasts. This has been tried and aban- ned in many instances by English vessels and their ws, owing to the threats of the Irish. The principal ings are for mackerel, herrings, cod, and all kinds of wl fish. The boats are principally lug-rigged.

Norway.

This being an international subject, our friends on the posite coasts must not be lost sight of. The herring and ckerel fisheries are those principally carried on by the rwegians. Trawling is almost unknown, the rocky nature the bottom round these coasts rendering it prohibitory. rwegian mackerel are largely imported to this country, d also lobsters. The boats employed are small and erior to ours, but steps have lately been taken by the rwegian Government to improve them by sending in- ctors over to the various countries which are foremost fishing, to watch the modes of fishing, and the classes and ild of vessels employed therein. They have also on the ommendation of the inspectors purchased specimens of craft which appear most suitable for their country, in ler to try them, and afterwards to build their own boats similar principles. By having superior craft they will enabled to follow the fish farther to sea, and thus reap tter harvests.

One great evil that has to be contended with on this ast is the freezing of the nets as they are hauled from e sea; this has to be counteracted by liberally sprinkling e nets with salt. The boats and gear are not usually ned by the crews. The share system is the mode of ment.

Sweden.

he remarks just made respecting Norway apply in a great ure to Sweden. A remarkable fact must here be noted which will show that all the laws that man can make will not always regulate fisheries. The herring fishery is recorded from the eleventh century. In the 16th, 17th, and 18th centuries mention is made of successive periods of herring fishing, and also of its disappearance at intervals of about equal duration, that is to say, from sixty to seventy years. Thus, from the year 1747 till 1808 there was a great activity in the trade, when the shoals of herrings disappeared, not to return till the winter of 1877, when they reappeared on the coast in their former abundance. The traditions of the country are that they will now remain about seventy years and then disappear again. The boats employed are a small class of vessel, but no doubt the improvements now being made by the Norwegians will be followed.

Denmark and Germany. Denmark and Germany must be passed over, as the fishing operations of these countries are of very limited proportions.

Holland. The operations of the Dutch in the herring and line fisheries are of vast importance. The trawling also must not be omitted. As regards the vessels they are rather behind us, though in their ideas of catching the fish they are considerably in advance. The coast of Holland is very flat, with a fine sandy bottom, and from April to August the flat or bottom fish draw in very close to the shore. Our own fleets of trawlers work these grounds in fine weather and do well. The Dutchmen having the fish so close at hand trawl in a small class of vessel known as schuits, some of them being open boats. In years past a very profitable business was carried on by some of our vessels, which used to fit out for what was termed sole-buying, which consisted of visiting the fleets of schuits and buying their soles, to bring over here. These often realized a handsome profit on the price given, and much money has been earned in this way. This trade is now nearly extinct, as Closh (as the Dutchman is termed by our fishermen) is getting wide awake to the value of his fish, owing to the increase of harbours and railways on his coast. The herring fishery, which they commence in June, is their principal fishery. They employ in it nets with a larger mesh than is used by any other country, the consequence being that all the herrings caught are very fine. These are cured on board the vessels as soon as caught, in the manner known as pickling. The gills and gut are removed and the fish being laid in barrels with salt, make their own brine or pickle. There are some restrictive laws still retained in this country as to the landing of herrings before a certain date, with a view to keeping up good prices at the opening of the season. Some of their vessels which belong to ports where there is plenty of water, are somewhat similar in build and rig to our own dandies, but those which belong to places where they are obliged to run ashore on the beach are of a most curious description. They are rather picturesque, being clench built, perfectly flat-bottomed, beam two-thirds of their length, in fact like an oblong box with just the angles and under corners rounded off. It is an impossibility to capsize them in the same way as our vessels, and the only way they have ever been known to do so is by turning stem over stern and going over lengthwise when lifted by strong seas. The smell on board these vessels is almost unbearable to any one not used to it, but it may be accounted for in two ways: one is, that the crews do not do much scrubbing down of decks, cabin, &c.; and the other that, it is impossible to get the bilge water out of them, as it is spread all over the bottom and does not drain to any particular part. They last only about eight years, owing to the straining caused by going ashore laden with fish. On the other hand, a curious fact may be noted here as regards their religious ideas. They usually hold prayer meetings on board morning and evening, and never commence a meal without saying or singing their grace, which by those who have witnessed it is not easily forgotten, such a thing being the exception on board our own vessels. As regards the liners from this country they prosecute this class of fishing for cod as far away as Iceland, salting the fish as soon as they are caught.

Belgium.

Belgium has had an unenviable notoriety as regards the instrument known as the Belgian devil, which has been the cause of so much damage to English fishermen's nets. The principal fishery prosecuted by this nation is trawling, and to this fact may be attributed in a certain measure their antipathy to our drifters. Trawling is prosecuted by awkward-looking cutter-rigged vessels usually of about 25 to 35 tons. The crews sometimes speak Dutch, sometimes Flemish, sometimes French. They usually work on the same ground as the Lowestoft drifters in the season, sometimes getting more northerly to where the Yarmouth boats are working; hence the complaints against them come from Yarmouth and Lowestoft only. There are some drift-boats belonging to this nation, but not a very large number.

France.

The fishing transactions of France are of large proportions. In many ways the French fishermen are ahead of us, especially as regards their craft and the working of their gear. This nation has some of the largest fishing craft in existence, which are schooners of from 150 to 200 tons, which prosecute the cod fisheries either on the Icelandic coasts, the Dogger Bank, or the banks of Newfoundland. These vessels generally salt their fish when actually engaged on the fishing grounds, and down their yards and work under fore-and-aft canvas. The principal class of vessels are those which are dandy rigged, whose size averages about 50 tons. They sail principally from the port of Boulogne, but there are also a fair number from the ports of Fécamp, Dunkerque, and Calais. They usually fish with lines or mackerel nets on the Irish coast from January to June, and herring nets from June to December on the North Sea. The system of payment was till recently a co-operative one, each man finding his share of the nets or lines, but this gradually died out, to give way to the ordinary share system, which was soon superseded by the standing wages system, and shipping of crews by the month (each man receiving about 100 francs per month), the owner providing all stores and provisions, and taking all losses.

The foregoing may be taken as a very brief description of the various craft which prosecute the deep sea fishing in the North Sea and off the west coast of the United Kingdom.

General description of nets.

Trawl.

The trawl-net may be briefly described as a long bag braided with twine, having a wide mouth, say 40 feet wide, gradually diminishing down to a long bag end about 3 feet wide. It is kept open at the mouth by the upper part of it being attached to a beam, which is kept off the ground by two iron heads, one at either end of the beam. These are about 3 feet high. A heavy rope is attached to the lower part of the mouth of the net, which drags along the ground, and which is shorter than the top portion, so that in dragging it along the beam and upper portion cover the fish before the lower part, on which is the heavy rope, comes up to them and disturbs them. They then rise and find themselves enclosed, and by the draught of water through the net are drawn down to the narrow end. The net is usually made in six pieces.

The top or upper part, the lower part or ground, the two side triangle pieces to form the mouth, known in some parts as the wings or gorings, and the long narrow part known as the cod end, which is made in two pieces, the upper and ground. These pieces are afterwards laced and hitched together, attached to the ground rope and beam, and the net is then ready for use.

The size of a trawl-net varies according to the size of the vessel for which it is intended. They are used with beams from 25 to 50 feet in length by deep sea trawlers, 40 feet being about the average length. Trawl-nets as used by the Belgians, Dutch and French are all similar in principle, and no good will be effected by describing all the minor differences. One may be mentioned, and that is, that the mesh of their trawl-nets is as a rule considerably smaller than that of our vessels. There is no law which regulates the size of the mesh or construction of this net, consequently many immature fish are destroyed which, if a means of escape were provided, would increase in size and benefit both the fishermen and the consumers.

Herring nets.

The herring net simply consists of an oblong sheet of lint, or net made of cotton, attached by twisted pieces of twine about 6 inches long, and known as norsels, to a double net-rope. Along the net-rope, at intervals, pieces of cork, measuring about 6 inches by 4 inches, are inserted, so that when the net is shot for fishing the lint sinks and depends from the net-rope, which is buoyed up by the corks inserted along it. Thus it drifts with the tide in a perpendicular position. In some cases a rope is put along the bottom of the net parallel with the net-rope, and sometimes weighted with lead or stones. This is for the purpose of causing the net to hang more steadily in the water, and is of more especial use in cases where the tide is strong and the lint light, as the former sometimes causes the latter to assume a partially horizontal position instead of a perfectly perpendicular one, which is the position required. The corks play a very important part in the fishing, either by their absence or their presence, as in various waters and at various seasons the net is sunk and worked at various depths, sometimes with hardly any corks at all on the net-rope. These depths vary from 1 to 20 fathoms, and the net, when worked in this way, is termed a sunk net. This happens more particularly in the early part of the North Sea voyage, when the fish are not healthy, and consequently do not rise much to the surface, or swim actively, but, as the fishermen term it, "skulk." When this is the case the net is held at the required distance from the surface of the water by seizings attached to each end of the net, and from thence to the bowls or buoys on the surface of the water. At other times and places the net may be either what is termed "swum" or "half-swum," as the case may be. In the former case the corks are numerous enough to keep the net on the surface of the water of themselves; then there is no strain on the bowls till the fish have struck the net, and caused it to sink by their dying and losing their natural buoyancy. In the latter case the net is less corked, say with only about half the number of a "swum net," and in consequence sinks in the water a few feet, till it is just checked from sinking further by the seizings from the bowls to the net having become tight. The half-swum system is adopted by many, not because they do not expect the fish to rise to the surface, but to prevent damage accruing to the net by vessels and steamers crossing over. They pass harmlessly over in this case, whereas in the other case the net would have been spoilt. The sizes of these nets vary according to locality. The Scotch boat will usually have a net of about 45 yards long and 20 score deep. The ordinary lugger's net will be about 22 yards long and 10 to 12 score deep. Foreign fishermen will usually have a net very similar to our luggers' nets in size and depth, they being often of British manufacture. The Dutch, perhaps, are an exception, their nets being very large and heavy, resembling more nearly the Scotch nets in size.

Mackerel nets. The foregoing description of a herring net will apply to a mackerel net, with the exception that mackerel nets are always swum, and have, of course, a much larger mesh.*

Foreign nets. The nets of the Norwegian and Swedish drifters are now made similar to the Scotch, owing to their having sent inspectors to learn the methods employed by the Scotch people in the herring fishery.

The Dutch herring net is a very large heavy net, the average size is 36 yards long, and 16 yards deep, of stout cotton, and is always of a large-sized mesh, about 34 or 36 to the yard, otherwise in principle there is no difference of note. The length of their fleet of nets is shorter than that of any other craft, owing to the enormous depth and weight of the nets. A French herring net more nearly resembles in every way an English east coast net, though it is generally deeper. There is no law to regulate the size of the mesh of these nets. Formerly there was one, but it was repealed as impracticable.

Pilchard nets. Pilchard drift-nets as used on the Cornish coast are similar to herring nets (English east coast) and are not regulated in any way by law as to mesh. These fish are also taken by seine-nets.

Deep sea trawling is prosecuted the whole year round on all coasts where the ground is fit for the purpose. The following are the principal fish caught by this means: soles, turbot, plaice, haddocks, cod, ling, conger-eels, whitings, dabs, brill, halibut, red mullet. Trawling is chiefly prosecuted in the North Sea, in a smaller degree in the English Channel, also in the Irish Sea and St. George's Channel, there being about 250 trawlers on these coasts, very slightly on the east or west coasts of Scotland, and hardly at all on the north-east coast of England till the year 1877, when, as before mentioned, steam-tugs were obliged to take up trawling. It has turned out so well that at the present time over fifty tugs are constantly engaged in trawling from Hartlepool as far as the Coquet Island, which have caused much ill-feeling between themselves and the line fishermen on this coast by trawling over the lines, and thus causing a loss of lines which was previously unknown.

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* The size of the mesh varies in different localities as the size of the fish varies. There is no law regulating the mesh of mackerel nets.

Fish caught on various coasts.

Trawl.

Herrings.

East and West coast, Scotland

Herrings are caught on nearly every part of the east and west Scotch coasts all the year round, for bait at least, but there are special seasons when the large shoals appear in a matured state. Off Ballantrae, on the west coast, the principal fishing is from January to March. The great fishery in the Minch is carried on from about the middle of May to the beginning of July. The east coast fishing commences about the middle of July and continues till the middle of September.

Sprats are caught on these coasts from November to January, with very little difference.

Cod, ling, hake, haddocks and skate are taken with lines all the year round on these coasts.

Berwick to Humber.

Herrings are taken between Berwick and the Humber from June to September; the remainder of the year, with the exception of the steam tug trawlers, is devoted to line fishing. In September mackerel are caught on this coast.

Humber to Lowestoft

On the east coast the spring herring fishing commences in April and finishes in May, when the boats leave off fishing for about a fortnight, and then go for midsummer herrings or fatguts. The old mackerel voyage, which used to be the great fishing of the year here, is now almost abandoned, as the mackerel appear to have deserted the coast. This used to be in May and June. These fish now make their appearance here about the middle of September and remain till the commencement of October. In October the great herring voyage from Yarmouth and Lowestoft commences and continues up to Christmas. There is very little line fishing done on this coast.

Lowestoft to Thames.

The fishings between Lowestoft and the Thames are of no particular account. There are trawlers from Colchester and also oyster dredgers, but these work all round the coasts of England as well as near home, especially the oystermen, who are continually seeking new beds.

Spratting is carried on in the Swin Channel by means of set-nets from November to January. There are also well cod vessels from Aldborough and Harwich, but these work as far north as Iceland for cod, and as far south as Plymouth for whitings, and are at work nearly all the year round at the various places they visit.

Thames to Brighton.

In the Brighton district the only fishing of note is the mackerel, which commences in May and lasts till about July.

Teignmouth to St. Ives.

The Cornish district has herring, mackerel and pilchard fisheries. The mackerel fishery is prosecuted principally from Plymouth from April to July, then the pilchard fishery commences from August till November. In December herrings come on the coasts and swim with the pilchards.

st coast, land.

On the west coast there are no drift fishings, but to the various ports a few deep sea trawlers belong.

Man.

The herring and mackerel fisheries of the Isle of Man are principally carried on by local boats which work from Kinsale to the Minch. The mackerel arrive on this coast about June and remain till September. Herrings are about here from October till January. A considerable amount of line fishing is also done.

Ireland.

On the Irish coasts the trawling, herring and mackerel fisheries are extensively prosecuted, but principally on the east coast. The mackerel fishing commences in April and ends in June. In July the summer herring fishery commences and continues till October, but in May there are shotten herrings which are sometimes fished for. A good amount of line fishing is also done.

Grievances.

Enough has now been said on this point to show how varied the fishings are on the coasts of the United Kingdom, and how carefully legislative measures must be taken. The periods named cannot be depended on, for wind, weather and temperatures make them vary very much; also the great difference in the craft, methods of working, and modes employed for capturing the fish has been shown; and further, how difficult it is to legislate for one district alone, as craft from one port go so far away to others, and work on different principles to the local boats though they are fishing for the same kind of fish. Let a few of the present grievances be considered which point to this difficulty. At the present time the principal grievance on the northern coasts is that the trawlers come from more southerly ports and damage or break away the gear of the line fishermen, and also of the crab and lobster fishermen. This is complained of by the Dutch also, who say that when our trawlers are working on their coasts they destroy their lines. At Hull and Grimsby the great grievances of the present time are the apprentice and desertions questions. At Yarmouth, apprentices being almost unknown, the principal grievance is the desertions question, and next the depredations by the Belgian devil. Lowestoft has three grievances, viz., the Belgian devil, desertions, and apprentices. It may here be explained why Lowestoft vessels have suffered more than any others from the Belgian devil. It is because the Belgian trawlers work principally on the same ground as the Lowestoft drifters, occasionally getting as far north as where the Yarmouth drifters are at work. This instrument, which has been the subject of a special Government enquiry, takes the form of a grapnel, but instead of the flukes being round they are flat and as sharp as the edge of a knife. This is hung over the trawler's bows, and cuts to pieces any gear with which it may come in contact.

As a drift-boat is frequently two miles from the poll or outer end of her nets these trawlers can do this on dark nights with impunity, as they take care not to show any lights. The instrument appears to have originated at Barking, which used to be the head centre of the North Sea fisheries, and was always carried. Sometimes a kind of saw was fastened to the vessel's stem for the same purpose, but happily this has been condemned and abolished for many years past by all English fishermen. These few examples of present grievances serve to illustrate how one district may suffer either from want of or from over legislation on a certain point which makes not the least difference to any other.

Classification of subject

For the purpose of continuing this subject *seriatim* it will be well to give now a practical explanation of the fisheries and how they are carried on under the present law, in the following order:—

1. The building, rigging, outfit, and insurance of the vessel.

2. The shipping of the crew, apprentices, wages or share, provisioning, and equipment for sea.

3. The mode of life at sea, manner of working single

ing and fleets, duration of voyage, methods of curing at and return to harbour.

The disposal of fish, and mode of settling up.

The capital invested in, and the annual value of the eries, and the number of people employed in or endent on them.

laving done this it will be possible to point out how the ent law affects the fisheries; how the proposed legis-n would affect them if carried out, and to conclude a few suggestions for the improvement of the said laws. s will be best done by omitting as far as possible legal is and forms, and avoiding many quotations from the chant Shipping Act, 1854, which is well known.

Building.

building a fishing vessel a full official survey for con-ction is not necessary as in the case of merchant ships, ey are not classed or lettered for any number of years; as the insurance clubs are as a rule mutual and local, e is no need of it for the guidance of insurance companies underwriters. The plan usually pursued is this: the r is given to build a fishing vessel of a certain size for a certain class of fishing. Upon the completion he vessel the builder hands to the owner a certificate ing that the vessel has been built for him, and the surement based on the instructions of the Act for that pose.

Registration.

he certificate just alluded to is then taken by the owner the vessel to the custom house, and the vessel is then sured by a Board of Trade surveyor. If she is over en tons a certificate of registry is granted, which gives particulars as to where, when, how and by whom she built, the measurement, the owner's name, or in the case here being more than one owner the number of shares by each. This register should always be on board the vessel for the purposes of identification and various other minor matters.

Rigging.

The rigging and providing of stores and utensils is then proceeded with according to the idea of the owner. This may be all new or partly new, or sometimes all old, having belonged to a vessel which has been condemned, the new one being built on the same lines and of the same tonnage; for though the hull may have been condemned the spars, rigging, sails, and stores may be in good order, as this part of fishing vessels is constantly being renewed. When this is the case the new vessel generally receives the same fishery number as the old one.

Insurance.

To insure the vessel is the next step, and this is entirely at the owner's option, and is generally done. The insurance clubs at the various ports are as a rule admirably conducted, and are usually registered under the Limited Liability Act. Periodical surveys are made of the vessels on a similar plan to that introduced by Plimsoll's Act, and in the event of any defect being found in the hull, rigging, or equipment, notice is given to the owner to put the same in order at once. These clubs also supervise the masters of the vessels and take cognisance of any neglect or bad conduct on their part. If, after notice has been given by any club to its members of the negligence, misconduct, or incompetence of any master, such master is employed on board any vessel insured in that club, no compensation would be allowed to the owner in the event of any damage occurring to the vessel of which such master was in command. Nets or gear are not insured under any circumstances, as this would be impossible. There could be no method of ascertaining the value of the gear lost, as nets are constantly being changed. In case of the total loss of vessel and nets the same would be the case. Thus, every owner of a fishing vessel which goes to sea must of necessity have a large pecuniary interest in her safety. This alone guarantees that everything will be done tending to the seaworthiness of the vessel, and consequently to the safety of her crew. It renders impossible also the offering of a premium on the loss of the vessel by over-insurance, as has been the case with merchant ships, which have been wilfully lost, after being over-insured by unscrupulous persons. Usually no vessel is allowed to be insured for more than two-thirds of her value. The mode of payment is a fixed percentage on the amount insured. In the event of funds being short in consequence of any unusually heavy losses, a further call would be made *pro ratâ*, but this is not often necessary. There is no special legislation as regards the insurance of fishing vessels, and there certainly is no need of any.

Shipping of crews.

The shipping of the crew and the making of agreements with them have for many years been a mere farce as far as the law is concerned. To those who have endeavoured to act in a legal manner by shipping their crews before the shipping master, a formal book of ten pages has been given. It is intituled "Half-yearly agreement and account of voyages and crew of a ship engaged in the home trade only," and was sanctioned by the Board of Trade in May, 1874, in pursuance of 17 and 18 Victoria, c. 104. It provides for the insertion of the name, official number, port of registry, port number, date of register, registered tonnage, horse-power if a steam-vessel, name and address of registered owner, master's name and address, certificate number if any. This is a very good beginning, but next follows a scale of provisions to be allowed and served out to crew during the yage, in pounds and ounces. This is a perfect piece of urdity, as will be shown further on when the pro-ioning question is dealt with, and even in the case of coasting vessels, which are more able to carry out such a system, is nearly always ignored by writing across it, "Sufficient without waste." Then follows a short general agreement, which, briefly summed up, is to the effect that the crew who have signed their names to it shall do everything that is proper, or be fined from half a day's to one month's pay, according to a scale which is given on page 9 of the agreement, which sets forth the fine to be enforced for various offences, and to which scale (any portion, or none of it) the crew have, when signing, to signify their willingness to be subject. The spaces left for crew to sign in are forty, whereas fifteen would have been ample, previous to the abolition of imprisonment for desertion, for any fishing vessel. Then follow spaces for account of apprentices, births, and deaths on board. The first and the last are reasonable, but the space for births is of no use for fishing vessels. Then follows space for endorsements by superintendents of Mercantile Marine and particulars of voyages, which are useless. Then the agreement finishes with instructions to masters, which are sections quoted from the Merchant Shipping Act, 1854, and are applicable to fishing vessels only in a very small degree; in fact, as they now stand, with regard to fishing vessels, are a mass of confusion. At the end of every half year this agreement should be deposited at the Mercantile Marine office by the owner or master under a penalty of no C. C. being granted to enable the vessel to be cleared at the custom house. Now as fishing vessels have never required nor would they be able to clear at the custom house, this said C. C. has not been required by them, consequently the agreement has been sometimes returned, sometimes not; and hundreds of agreements that have been returned have been very

orrectly filled in, but as they are practically useless,
notice has been taken of it, and no one has suffered.
is agreement is very reasonable in the case of a coasting
go vessel, where, as is frequently the case, the crews
ain the same for several years, the only alterations
ng caused by illness or death ; but to endeavour to
ly it to fishing vessels shows what great ignorance
existed as to the requirements of the fishing trade
s admitted that this agreement was of some value
ious to the passing of the Payment of Wages Act,
, whereby imprisonment for desertion was abolished,
use if a man deserted and was apprehended and
ght before the magistrates, they had the power to
rison him ; and this alone made it worth while for the
er and the hard-working part of the crew to go to the
om house or marine office and pay the fee of four
ings, which is the authorised fee for signing the crew
vessel under eighty tons. But, on the other hand, by
passing of Plimsoll's Act, and the Crew Spaces Act, a
-sighted man had another weapon put into his hands
arious times by threatening the owner or master that
e had him apprehended he would call in the Board of
de surveyor, and point out any small discrepancy
h might exist between the vessel as she was and as
ought to be in order to strictly conform to the Board
rade regulations, which were framed for cargo ships,
were impracticable as far as fishing vessels were con-
ed. This was plainly shown, firstly in the Crew Spaces
r which, when applied to fishing vessels, proved that in
e cases if the whole vessel had been converted into ac-
modation for crew the cubic space for each man would
have been sufficient to comply with the law ; secondly,
e case of the sanitary order, which made it compulsory

for every vessel to have a closet for accommodation of crew on deck, and also in other minor matters, which, though perhaps necessary on board a ship, every practical fisherman knows to be perfectly inapplicable to a fishing vessel, though accommodation of the kind last mentioned is desirable.

Apprentices.

These are mainly composed of boys sent from some union, reformatory, training-ship, industrial school or boys' home. There are two classes in the trade, the indoor and the outdoor. Boys are usually sent to sea on probation, some for as long a term as six months, to enable them to see whether they wish to become apprentices. It usually turns out that they do wish to be bound. In the case of an indoor apprentice the usual plan is for the master to agree to teach him the business of a fisherman and seaman, and provide him with sufficient meat, drink, lodging, washing, medicine, medical attendance and pay him a nominal sum per annum, and further provide all clothes, sea bedding, wearing apparel, and necessaries. This is the legal part of the business, but the custom is for the master to allow the apprentice say, eighteenpence per diem (the amount varies at different ports) for each day that the vessel is in port. This is usually known as "spending money." This apprentice will usually reside with his master, and live at the same table when ashore, but sometimes when an owner has several vessels he will not have sufficient accommodation at his own house. He will therefore find them a respectable lodging, most probably with the man or men whom he employs to do the necessary part of the work connected with the vessels ashore. These boys cannot help being happy and comfortable unless by their own acts. It is a noted fact in most fishing ports, and is to be seen every day, that boys going to sea for the irst time, looking pale, and thin, and hungry, come back in he course of a few weeks, looking fat, strong, and healthy, n many cases hardly a vestige of their former selves emaining. The out-door apprentice is bound differently. The master agrees in this case to teach him the business of a fisherman and seaman, to provide sufficient meat, drink, lodging, medicine, medical and surgical assistance during the time that he is at sea only, and pay him for each consecutive week of the first year and every year of his apprenticeship a certain sum of money, which increases in amount every year as a rule. Out of this the apprentice has to provide himself with all sea bedding and wearing apparel when at sea, and when ashore with everything. This aw of apprenticeships worked very well till the unfortunate assing of the Merchant Seamen Payment of Wages Act, 880, which completely overrode all apprenticeship indenures which had been or were subsequently made. By this Act the boys were freed from their masters, and desertion ecame the order of the day. It is a well-known fact that oys of this class need, when commencing life, to be trained and put under some kind of restraint; if left to themselves hey are very liable to get into difficulties which they do not see till it is too late to retrace their steps. As a rule the best masters of smacks and fishermen are those who have served a full apprenticeship. Hundreds of instances could be given where boys, who would have turned out steady, sober and useful fishermen, and a value and credit to their calling and country, have become, through being reed from any restraint, useless, drunken vagabonds, ramping from port to port, shipping to vessels in arbour simply for a night's lodging and a good meal r two, with no intention of ever going to sea to do any work, but deserting when the vessel was ready for sea and then shipping to another vessel to do the like again. So they have gone on till they have got too well known in one port and have tramped to another, to remain there till the game was once more played out. In this manner the round of the ports of the kingdom is done. This system has also been pursued by some men who have taken advantage of the Act to pursue a course of idleness and vice. But this has been only a portion of the bad effect of the passing of this Act on boys. However good the intentions of the framers of it may have been, it has acted most unkindly and cruelly on the apprentices and crews of fishing vessels themselves, besides inflicting the most serious pecuniary losses on owners. Since the passing of the Act it has been practically useless to bind boys as apprentices; owners are therefore ceasing to do so, and employing lads and boys by the week. They are consequently taught nothing, to their own future detriment and that of the industry itself.

Payment of crews.

The modes of payment of crews of fishing vessels are very varied. They are entirely different under different circumstances, such as ports, class of vessels, and nature of fishing to be prosecuted. It will be sufficient for the purpose here to give them generally. In Scotland the co-operative system is principally pursued; the crew provide the boat and nets between them and share according to the proportion of gear contributed by each. An evil which in some cases has been found to accompany the co-operative system may here be pointed out. It is the stealing of gear or misappropriation of any that is suitable and may happen to be picked up at sea. In many instances, the crews, through being owners of gear, have been induced to retain what they have picked up, whereas, had they been paid only by the share, gear being of no use to them, they would have delivered it up to the proper authority, and claimed the salvage. This applies internationally as well as nationally. The northern English ports work on the same system in drift fishing, but the steam trawlers sail by the week, and in addition to this either the whole or part of the crew will receive a percentage or poundage of the net earnings. This percentage decreases from the master downwards according to the rating of each hand. On the east coast trawlers and codders work on the same principle, though sometimes the whole crew may be paid by the week, the owner finding the provisions, and no poundage; but this latter is only done in the case of trawlers sent to a fleet, for there they are under the supervision of the admiral as to shooting and hauling their gear; and if, when the carrying cutter or steamer comes in, the owner finds that his vessel does not send in on an average as much fish as other vessels at the same fleet, he then ascertains the cause. Codders are sometimes entirely on weekly wages. Drifters, on the contrary, are never on weekly wages on this coast, they either sail by the share or by the last, that is, the owner agrees to pay them so much for every last of fish sold irrespective of high or low prices, which he risks, but this system is not nearly so common as formerly.

Payment by the share is as follows. After the expenses of the voyage, such as ice, salt, provisions, lost and spoilt nets, or any other deductions agreed on, have been deducted from the gross earnings, the net proceeds are divided between the owner and crew, very often half and half. Then in this case, as in the former one, the shares for the crew vary from a share and a half for the master to a quarter or half-quarter share for the boy. The trawlers on the south coast are paid similarly to those on the east coast, but the plans of the drifters more nearly resemble the Scotch. In Ireland the share system is in force. The west coast trawlers work similarly, to those on the east coast. The Manx boats much resemble the Scotch with their co-operative plan. The Norwegians, Swedes, Belgians and Dutch all sail by the share, but no hard-and-fast rule can be laid down, as these systems vary from time to time according to successive good or bad seasons and other causes. The French used to sail on the co-operative system, each man as far as possible providing nets; but this has of late years changed to the crews sailing by the month, the average rate being 100 francs per month, the owner finding the provisions and taking all losses. In some cases the crew find their own provisions, but this is the exception. Cases of dispute sometimes arise where a shareman has been injured or taken ill for a period during the progress of the voyage, and a substitute has been shipped by the master or owner regardless of the cost to the man whose place is filled, and looking only to his own interests in losing no time. The voyage is afterwards completed by the sick man on his recovery. Sometimes the sick man will find his own substitute. These disputes might be avoided by power being granted to an independent official to supervise such cases immediately on notice being given.

Ballast and hatches.

The ballasting and means of securing the hatches of fishing vessels is not altogether satisfactory, though in the opinion of the writer it would soon be willingly remedied if attention was called to it from the proper quarter.

The ballast is frequently iron, covered with stones, shingle, or iron-stone.

In some cases simply loose boards are laid either wholly or partially over it; in other cases the boards are fastened down in various ways, though not always securely. The best plan for doing this is to have stanchions properly fixed over cross-pieces across the bottom boards under the deck beams. Then the ballast could not possibly shift. After the terrible January gale a few years back, when many smacks were lost and others laid on their beam ends for hours, all that arrived in port had their ballast more or less shifted; one vessel, which the writer saw when she was being dismantled, was a notable instance; the iron ballast which was stowed in her bottom had got to the top of the shingle, and the fish which had been on the top were found next to her keelson, her boards being mixed up with the whole. Another instance occurred at another port in which the vessel's trawl rope was found under the ballast, and the side lights which were usually kept aft on the water-casks were found under the ballast forward. The hatches are frequently without proper means for their security, though where vessels are in good clubs this is specially attended to, but when at sea they are frequently stowed away and are either not forthcoming at the right time, or neglected to be used, owing to the carelessness which is caused by constant exposure to danger. Here again there is a difference between a cargo ship and a fishing vessel. The former has her hatches well secured before leaving port, and they remain so till her destination is reached, while the latter is constantly uncovering and using the hatchways in all weathers.

Provisioning.

The next point is the provisioning of the vessel. In cases where the crew sail entirely by the share, the provisions are charged to the owner who is responsible, and are either ordered by him or the master. At the end of the voyage the amount of these is deducted, with other expenses, from the gross earnings, and is kept by the owner to pay the various accounts, the net amount only being divided. If the vessel happens to be unfortunate enough to earn nothing, as the law now stands the owner remains responsible, and the crew walk ashore free men with no responsibility. It is a question whether in this case the owner and crew ought not to be responsible to the tradesman in proportion to the share each stood to receive, and not the owner to be responsible for the whole.

To compensate the tradesman for running this risk it might be suggested that, when provisions have been supplied to a boat sailing by the share, he should be entitled to be present at the settling up to receive the amount due to him. This right doubtless would only be exercised in exceptional cases, and not when the owner was known by the tradesman to be an honourable man.

Cases have been known where the owner has received this money at the settling up, and appropriated it to his own use for other purposes, afterwards liquidating, and the tradesman has had to suffer, although the money to pay for the provisions he supplied was duly earned and paid by the crew as far as they were liable. It very often happens that a portion of the crew live a long way from or have no home, and these immediately commence to live on board, and even those who live at the port will probably live on board but go home to sleep. Men have openly admitted in some cases that they have shipped to what may be termed the "by voyages," not that they expect to earn anything, but "just to ease the old woman at home by keeping their heads out of the cupboard," which means that the owner will have to pay for the provisions whether the vessel earns anything or not.

It must here be noticed that in the last ten or fifteen years a vast change has taken place in the way the crews of fishing vessels live. There are men now living who can remember the time when no meat was allowed on board at all, or at most only once a week. The fare, from the commencement of the voyage to the end, consisted as a rule of biscuits, herring, or other fish, when there were any to be caught, varied by a piece of cheese, and water to drink, there being only a small bogey stove just to warm the cabin; whereas now fishing vessels are supplied with tea, coffee or cocoa, bread (biscuits for standby only), butter, cheese, flour, potatoes, plums, currants, fresh beef, bacon, treacle, vinegar, mustard, pepper, salt, preserved milk, beer at some ports, and sundry other comforts, even to a cooking range with oven, so that a baked meal may be had as well as boiled or fried. It has been well said that a ship sailor would often envy the fisherman of the present day could he see him at his meals, and this without having any agreement or scale as to what he shall be fed on. It may be averaged that a fishing vessel's crew at the fleet will cost from eight and six pence to ten shillings per head a week—at single boating or drift fishing the latter-named sum or a little more, as these are more frequently in port, and can consequently get fresh provisions in the shape of bread, beef, vegetables, &c.

Equipment with gear.

To equip the vessel with her gear is the next thing. If she is a trawler there is not much to do. The owner finds the net (though this varies at different ports and under different circumstances), which is in several pieces, as before described. The duty of the crew is to reeve it up, and seize it on to the ground-rope, afterwards fixing it to the heads and beam. The ice, if required, is then got on board. In a drifter where the owner finds the gear a portion of the crew will go to the owner's store and load the carts which are to convey them to the vessel; the remainder of the crew "lean them up," which means, fasten them together, and stow them in the net room. In a codder the crew will have to "thorough-foot" the lines, which is to take out the kinks which always exist in new lines, hitch on the hooks, which the apprentices in some cases have to whip on to the snoods. This class of vessel has also her bait to get on board, either whelks, herrings, clams, or sometimes sprats. The lines are then coiled away in the flaskets or trays, as the case may be, ready for the apprentices to bait.

At sea.

Herring driver.

The vessel can now proceed to sea, for there are no custom house formalities to be gone through as in the case of a ship. So long as her port letters and fishery number are painted on properly she is free to go. The master will then set the watches, or leave it in some cases to mutual agreement, as there are many more difficulties in the way of keeping regular watches on board fishing vessels than there are in sailing ships, such as attention to the fishing gear, as well as the navigation of the vessel, the frequent return to and leaving of port, and, in some cases, the getting out of cargo. The boy as a rule is cook; if a novice then under the superintendence of possibly the mate or some other of the crew, as it is generally considered the duty of the master to navigate the vessel to and from the fishing ground, though when this is a long distance he is relieved by the mate. When the master has seen the gear duly shot and the vessel made snug, it is his turn for turning in, to be called at a certain time to haul the gear, or under certain special circumstances. The first few nets nearest the stem of the vessel are termed the "look on" nets, as whenever it is thought proper, the watch, on a fine night, will haul the boat up to them and haul them in to see whether the fish are on the move or not. If there are only a few in the nets they are shot away again for another hour or two, but if there is a good look on the crew are called to go to work and haul the fleet. Other drift fishings are similar.

Trawler.

A trawler is not able to do this; when the hauling is commenced it must be completed. Owing to the gear having increased a good deal in size and weight of late years the practice of some trawlers has been to make long hauls, some even as long as four tides instead of one as should be. This is done to save the labour of hauling, which will average a good hour's work. The fish in these long hauls are much bruised and spoilt, and will not keep so well as those hauled more quickly, and all the small fry are killed. But it may be expected that the introduction of steam capstans will do much to alter this, as by this means the hauling is done in about half-an-hour, with very little labour. There is not much variety in the mode of life aboard fishing vessels. The cabins are of necessity small, though much improved of late years. Occasionally some member of the crew will while away the time with music from a concertina, or in fine weather draughts may be played on the companion way (there being no room for tables in most of the cabins), or they sit and read, but of course there is no chance of this in bad weather or when large hauls of offal fish are made, as these take much time in cleaning and icing.

Single boating.

Trawlers work in two ways, either single boating, which means bringing in the fish they catch themselves, or in fleets. The duration of a single boating trip is from three to fourteen days, according to the success met with or the stock of ice. Several tons of this are usually taken.

Fleets.

A fleet will consist of from about a score of vessels to two or three hundred sail. The smaller fleets will only be temporary fleets, possibly for a few months in the summer, and not working far away from port, where a few owners co-operate and each vessel takes her turn to bring in the fish of the others every day. But the large established fleets, of which there are several in the North Sea, such as the Hull, Grimsby, Hewitt's, Lowestoft, Ramsgate, and others, are generally working all the year round, and are served by regular steam or sailing carrying vessels. Vessels join or leave as their time expires, and go to whichever fleet the owner desires. Such a fleet is commanded by an admiral, usually selected by the principal smack-owners for his superior qualities or experience. He flies a distinguishing flag and signals his orders to the fleet when to shoot the gear, and when to haul, tack or otherwise, and in some fleets, what is most important, decides whether the weather is fit for the vessels to get out their boats to convey the fish to the steamer or cutter, which is waiting to convey them to market. This rule is rigidly adhered to in some fleets by special orders from the owners. The admiral also leads the fleets to various grounds wherever he judges best. In some cases he is paid by weekly wages, a share of his own catch, and fifteenpence for every hundred packages of fish caught by the fleet; in other cases half-a-crown for each time the fleet shoot their gear by his orders, or other similar methods. There is generally a second admiral in the fleet who is appointed to take charge in case of accident, or when the admiral in command leaves the fleet for home, his time being expired.

Coopering.

It is at these fleets that so much harm is done by the system known as "coopering," which is usually carried on by vessels sailing under a foreign flag, which are nothing more than floating grog and tobacco shops. They dispose of their goods either for cash, stores, or clothes of any kind.

thus sometimes inducing crews to part with their spare nets, sails, anchors, &c., which they get replaced by sending to their owner by the carrier to send out fresh nets or other things, as "the others have been lost," and sundry other excuses. But the evil does not end here, for sometimes three or four masters will order out their boats and meet on board the cooper, giving orders to their respective vessels to lay by them, sending back by each boat a quantum of spirits and tobacco to keep the mouths of the remainder of the crews closed. The result of this has often been that all have got helplessly intoxicated, thereby endangering their own lives, the lives of others, and the property of the owner, besides losing the night's fishing. Sometimes it has happened that in the night the smacks have got parted from the company of the cooper, and the next day has to be devoted to finding the master again, and possibly the mate too, who are on board the cooper. Some of these vessels are almost as luxuriously fitted up as a gin palace, with mahogany glass-racks, mirrors and couches, almost incredible to those who have not witnessed it. Only this year (1882) a trawl-net belonging to a Yarmouth owner was discovered at a northern English port, which on investigation turned out to have been brought there by a vessel belonging to the latter port. This vessel had been coopering during the summer months, and taken it in payment for contraband goods. The merchants on the other side are very accommodating to vessels wishing to go into this trade; they supply goods on credit, sale or return, simply causing the cooper to insure them against loss. Winter does not suit this trade, owing to the bad weather usually experienced in the North Sea, and the consequent difficulty of boarding, and the long dark nights. It has been suggested that if fishing vessels were allowed to have tobacco out of bond it would stop this traffic, as this is the excuse made for boarding these coopers, and then purchasing spirits; but if this were done it would practically fail in its object, as there would still be the excuse of buying Eau de Cologne, Dutch drops, meerschaum pipes, concertinas, &c.

The writer may here describe one way in which he has witnessed this traffic carried on. It can only be done in very fine weather or calms. The smacks lash themselves alongside the cooper and drift about with her. Communication from one vessel to another is thus made easy. Concertinas and dancing form part of the amusements. On one occasion a few years ago, no less than twenty-one vessels were thus lashed together. The old well-known cooper, the "Long Betsy," as she was called (since lost), was about the centre of the lot, and at one end another cooper, a Dutch smith, had taken up her position. These lay becalmed in this way for four days and nights. During one of these nights a man of war, bound from the Baltic to the Downs, hove in sight, and not being able to understand the long row of lights and the noise, sent her steam launch to ascertain what it was. There is a regular vernacular or slang in this business both among sailors and fishermen, such as "Can you dress a hat?" meaning, Do you want to buy any contraband goods? and other phrases of like nature.

Carriers.

The carriers are sometimes owned by salesmen, who convey the fish to market as well as sell it, at a fixed commission for the whole service, including the use of packages, or simply convey it at a charge to market to the order of another salesman. At small fleets the vessels frequently take it in turn to bring in each other's fish.

Mackerel fleets are sometimes formed on this principle ut as a rule drift boats and codders work independently. ystermen work as a rule in small fleets, but they, of course, an keep their catch alive for a long time.

Curing at sea.

This brings us to the various methods which are em- loyed in curing or preserving fish at sea. Trawl fish are variably iced. Herrings, unless brought in fresh, are ither dry-salted loose, or put into barrels and pickled with alt, making their own brine; this latter plan is the xception on board English craft, but the rule with Dutch nd French boats. Codders either keep their fish alive in well in the centre of the vessel, or make a salt-fish voyage, hen all are salted. Mackerel are generally brought in esh the second or third day according to the weather, ut an idea is now gaining ground of providing these boats ith refrigerators, so that when the catches are small they an stay on the grounds longer than they otherwise could.

Ferrying and boxing or trunking.

In connection with the fleets a most important point the ferrying of the fish from the fishing vessel to the arrying vessel. A good deal of attention has been ttracted to this, owing to the loss of life which has occurred hrough it. After the fish is caught by vessels of the eet and packed in boxes, it is necessary to convey it to he carrying vessel which is waiting to convey it to market. or this purpose the small boats must be launched. As rule these are very strong, safe boats, about 16 to 8 ft. long, and of good depth and beam, and as good as ossible for the purpose. The fish is then put into the oat and two or three hands are sent to board the carrier, he smack looking out to pick them up again when they ave delivered the fish. It will now be asked, if the boats re so suitable, what is the cause of the loss of life? It ay be attributed to the following causes. The attempting o ferry when the weather is not fit; the overloading of the boats to save making two trips to the carrier, and consequently, not leaving enough freeboard, and further, preventing those in charge from having sufficient room to manage the boat properly; the breaking of tholes; the sending of inexperienced hands in charge, which is caused in some instances by experienced men, who, knowing the danger, if no rules are laid down, ship on condition that they shall not be liable to go in the boat for ferrying purposes. The principal loss of life from this cause will be found to have occurred at the fleets which fish most northerly. And this for two reasons: one that there is invariably more sea, the other that these fleets get heavier catches in the shape of offal fish (principally haddock), and the boats are overloaded to avoid making two trips. The more southerly fleets, which fish principally for prime, seldom get more in one night now than a boat will fairly carry. As before remarked, in some fleets the admiral is charged with the duty of signalling whether the weather is fit to board the carrier or not. If he signals "No," the carrier hoists the same flag, and refuses to receive any fish, should any one try to disobey the admiral's order, which is seldom the case.

A few points of importance may here be noticed. The greatest loss of life will be found to have occurred where the fleets are tended by steam carriers. Where sailing cutters are employed the sails are so set as just to keep the vessel steady and "dodging" ahead, whereas in steam carriers the propeller would have to be kept going to do this, and would be dangerous to the boats hanging on.* It must be borne in mind that this boarding is not merely two or three boats going ongside at 'a proper gangway and methodically dis- arging their freights one after another, it is more like a varm of bees round a hive. The steamers have ropes ng round them for the boats to hold on to, the boats ce to get their freights delivered quickly and hang to e steamer to windward as well as to leeward and tern, and pour their fish on to the steamer's decks, ese being sometimes piled higher than the bulwarks. ther boats come alongside, and finding all the proper pes already taken up are obliged to make their own inters fast where they can. The result of this is at the fish is poured on to the steamer's deck faster an it can be stowed below. The steamer all this time dropping to leeward faster than the boats alongside, hich get their heads turned to the steamer's stern. The aster of the steamer then seeing that he is getting over- one, and that more boats are on the point of coming along- ide, steams ahead to get clear of them by leaving them to eward. He will perhaps chop away all the boats' painters hich are made fast to the steamer and not to the proper opes. Those boats that are allowed to hang on are then wed ahead without having time to turn their heads to e steamer's head, and are consequently towed sharply und. Sometimes they get thawt-hawse one another, or e ropes foul and they are thus capsized. Men on board e steamer, whose boats are cut away have to get back them as best they can. Those boats on the point reaching the steamer, being left to leeward, have to ake for their vessel again to be towed to windward of e steamer and make a second trial, which is a double risk. e boats being well loaded pull heavily, and the tholes e often broken; these should be made of metal and tached to the boat. It is true that the masters sometimes go in the boats themselves, but this is as a rule in fine weather, when, as has been well said, "you cannot kick them out of the boat." They go aboard the cutter or steamer and meet other masters and spend the time having a quiet pipe or glass of grog. But in bad weather the master will go below, make out the "note," bring it up and hand it to the mate or one of the crew, and no further order is necessary to board the carrier. If legislation or rules should be hereafter framed dealing with this point, it would be well to make one standpoint, and that is, that no ferrying should be carried on while less than a one-reefed mainsail is set. Also that the signal to board should at no time be given unless the cutter has spoken the admiral and both are agreed on the fitness of the weather.

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* The steamer's sails are sometimes set, but are only of use to steady her, and cause her to blow to leeward.

Trunking is the term applied to fetching empty boxes from the carrier. In this case boats are frequently so overloaded as to leave no room for the management of the boat. Some will pile them up two deep above the gunwale all over the centre of the boat. One man has just room in the bows to look out for the rope when the smack picks them up, the other is aft, perhaps sculling, or allowing the boat to blow where she will. When the smack heaves them a rope, it is sometimes missed by the bowman and got by the sternman, who cannot pass it forward owing to the boxes, and the boat is in consequence towed stern first. Some owners, where six or seven hands are carried, always cause three hands to man the boat, but this is not the rule.

Duration of voyages.

The duration of the voyage of a trawler when fishing with the regular fleets will vary, according to ports, from six to eight weeks, during which time she will not return to port except in case of severe accident to any of the crew or to the vessel; in case of slight accident, or provisions running short, the master will send a letter to the owner by the carrier, who will send off to him by the same means whatever is required; or in the case of the carriers running to London, then by the next vessel leaving the port to join the same fleet. The voyage of a trawler, when single boating on various parts of the coast, depends on the catch of fish, the quantity of ice on board, and the weather, and will vary from three days to a fortnight. The voyages of drifters on various coasts are from one to six months, but of course these vessels are frequently in and out of port, as they, like single-boating trawlers, bring in their own catches. It would be almost impossible for them to do otherwise, except, as is sometimes done in the mackerel fishing, when the catches are small; then one boat will bring in the catches of the others. A codder, if weather permits, will generally remain away till the well wherein the fish are kept alive is full; or in the case of making a salt-fish voyage, when all the fish caught are split and salted, the vessel will perhaps remain away till it is full.

Return to harbour.

Sale of fish.

Having thus briefly described the principal portion of the sea doings of the vessels, the next thing to glance at will be the return of the vessels to port to dispose of their fish. In this, as in other branches of the trade, there is no general rule, so a description of the various plans is desirable. In Scotland herrings are sold by the cran measure, which contains from 800 to 1000 herrings according to the size of the fish; but the boats here are nearly always hired, perhaps nine or twelve months beforehand, by the curers, who give a sum of money as a bounty, reaching in some cases to nearly £50 for first-class boats. The curer then agrees to take up to a stated quantity at a fixed price. If the season is a good one, and the quantity agreed for is taken, a fresh price will probably be arranged for a further stated quantity. Line fish, such as haddocks, sillocks, cod, &c., would be sold by the cwt. But in England the usual system in the case of trawl fish is to sell by the package on the spot, or to send away to a salesman at an inland market. Herrings are always sold when landed, by the last of 10,000, which consists of 13,200 fish, or by the 100, which consists of 132 fish, which number arises from an old custom which had for its intention that the price per 100 to the public should be the same as the wholesale price, and the profit of the wholesale buyer or curer was to be sixteen fish, and that of the retailer sixteen fish. The sales are sometimes effected privately, but generally by auction. Discount is allowed in some ports for prompt payment. Sometimes a salesman sells, and the owner books the debts, and collects his own money, thus freeing the salesman from risk of bad debts, in which case half the usual commission only will be charged. There has been a good deal of discussion at various times on a curious anomaly in the law as regards the selling of fish by auction. For instance, a vessel arrives in port with fish, these are landed and can be sold by auction by any one without a licence; but suppose these same fish were landed and not then sold, but consigned to an inland town, or when the wind is light or contrary and the vessel cannot conveniently reach her port, the fish are landed, to save market, at the nearest village and sent by cart to the market, then in either of these cases they must not be sold by auction by any one who has not an auctioneer's licence. This certainly is an unnecessary piece of red-tapeism. Mackerel are sold by the 100 of 120 fish because the fish being more valuable ten were considered sufficient profit for the wholesale buyer and ten r the retailer. Line fish, such as cod, haddocks, &c., are ually sold by the score, except in cases of odd lots. One eat grievance with respect to the sale of fish is, that reign vessels are able to catch herrings off our coasts, ing them into our harbours and dispose of them without ing liable to any duty, whereas an English vessel doing e same in a French port would have to pay about irteen shillings per barrel duty, or in a German port three illings. This is obviously unfair, as herrings are not the oduce of any particular country but common to all alike.

Settling up.

Settling up as now practised by the trade is done ivately, no official notice being taken, as in the case of ying off ships' crews. If the fish have been disposed of the port where landed, and not sent away for sale and, the settlement will very probably take place at the lesman's office, or in the case of a large owner at his ice, or in the case of a small owner possibly at a public-use. These settlements are in most cases perfectly tisfactory, but out of such a large number disputes are nost sure to occur sometimes. The remedy in this case s always been the county court, which is not very isfactory, being very slow and tortuous.

Value of fisheries.

In England there are no means of ascertaining the exact mber of fishing vessels, and men and boys engaged, but e following are calculated from the best means at disposal.

ENGLAND, WALES, ISLE OF MAN, 1882.—Registered d unregistered 1st, 2nd, 3rd class vessels, 15,469, includ- g gear valued at £4,698,550; 65,795 fishermen employed; lue of fish caught, £3,682,287. From this amount all ges, shares and expenses have to be deducted, the balance ly being interest on capital. Besides the above labour, ere would be specially connected with and dependent the fisheries about 70,000 more persons, consisting of owners, salesmen, buyers, curers (men and women), ropemakers, twine-spinners, cotton-net operatives, package makers, sailmakers, shipwrights, caulkers, carters, &c.

SCOTLAND.—The boats here are as a whole much smaller and less costly than the English, though each year they are advancing both in size and cost.

The estimate of registered and unregistered boats for 1882 is as follows: 14,809 boats, including gear valued at £1,398,461; 48,121 fishermen; value of fish caught, £1,191,871; 48,752 other persons in various trades dependent on the fisheries.

IRELAND, 1882.—Registered and unregistered, 945[illegible] vessels of all classes, including gear valued at £816,640; 34,528 fishermen employed; value of fish caught, £467,014; 12,000 other persons in various trades dependent on the fisheries.

FRANCE, 1881.—20,617 vessels; tonnage, 153,870; 73,342 fishermen; value of fish caught (North Sea only) fr. 96,000,000 (£3,840,000); 30,000 other persons dependent on fisheries. The shore labour is less in proportion to England owing to the fish not being prepared and manipulated in so many different ways.

HOLLAND, 1881.—1021 vessels; 5986 fishermen; value of fish caught:—

Herrings . . .	294,500	barrels	=	Florins	3,534,000	=	£294,5[illegible]
Anchovies . .	15,458	ankers of 50 kilos.	=	„	772,800	=	64,[illegible]
Oysters . .	21,844,672		=	„	1,310,000	=	109,[illegible]
							£467,5[illegible]

NORWAY, 1879.—Value of fish caught on own coast, £12,800.

SWEDEN, 1879.—217 vessels; 1828 men; value of fish caught, £184,518.

This concludes a brief description of the manner in hich the practical part of the fisheries is carried on under e present law, which will be of great assistance to the ninitiated in understanding the next portion of the subject be dealt with, which is,

First. The effect of the present law,

Second. The proposed legislation, and what the effect it would be, if carried out.

Building.

The present law relating to the building of a vessel and e consequent survey by a Board of Trade officer appears work satisfactorily.

Tonnage.
Registration.

Registration is undoubtedly a most desirable thing, but e effect of the law as it now stands is that, owing to a ant of clearness, a small east coast boat of fifteen tons is gistered, while a Scotch boat of possibly twenty to twenty-ve tons escapes under the pretext of being an open boat. hese craft were formerly open boats, but as the fisheries ve progressed, so the boats have improved both in size nd build, and from being open and half-decked, they ve now got to be practically whole-decked, though rtainly their hatchways are large, on account of the size nd method of working their nets. Besides this, they now sh farther away from port than they used, and travel to rts hundreds of miles from home, and yet up to the esent have not come under the law for registration. t some west country ports, also, hundreds of fishing ssels are not registered for tonnage, under the same etext. An inducement to some owners to keep down nnage, and not to register it, is that by being ungistered they pass for under fifteen tons, and by this means tirely escape harbour dues at some ports, and at others get f for a very trifling sum compared with what they would ve to pay if they were registered. Now that the subject of registration is under consideration it will be opportune to consider the 19th section of the Merchant Shipping Act, 1854, which states that, "every British ship must be registered in manner hereafter mentioned"—"except ships not exceeding fifteen tons burden employed solely in navigation on the rivers, or coasts of the United Kingdom." The question then arises what constitutes the coasts of the United Kingdom. The Act does not give the information, and it is a difficult question to answer. The draft of the proposed addition to the Act of 1854 relating especially to fishing vessels now (1882) before the public states (subsection F.): "That fishing vessels which are exclusively employed in fishing on the coasts of the United Kingdom are such fishing vessels as do not proceed to sea for the purpose of deep sea fishing at a distance of over seven miles from the coasts of the United Kingdom for a period, in the case of vessels propelled by steam, exceeding twenty-four hours, and in the case of sailing vessels, exceeding forty-eight hours from the time of leaving their last port of departure for the purpose of fishing." This definition, emanating from the Government, must be taken as the correct one, though it may be noticed that it would be very difficult to carry out, as no allowance is made or rule stated for bays and headlands. It shows, as may be seen from the general description of the fisheries before given, that several thousands of vessels are not registered under the Merchant Shipping Act as they ought to be. Consider the number of the Scotch boats alone, which nowadays proceed nearly 100 miles from land for fishing purposes. Not these only, which are not registered for tonnage, but all fishing vessels that are registered, are acting illegally by proceeding to sea without a clearance or transire, according to the latter clause of section 19—a thing which is totally unknown in the fishing trade. As it has been ruled by courts of law that no custom can override law it is evident that either the vessels must be compelled to clear or the law be altered. As the former is impossible the latter must be done. Again, it must be noticed that the words used are "under fifteen tons *burden.*" This clearly is not tons *register*, which is the basis on which this section of the Act is carried out. Article 5 of the Sea Fisheries Act of 1868 also distinctly mentions the tonnage as the burden tonnage, not register.

Shipping of crews.

The effect of the present law as regards the shipping of crews is practically nil, as crews are not now shipped at the custom house, as formerly. The agreements are sometimes verbal, sometimes on a short form, according to the idea of each owner. The form of agreement for home trade ships was used for the purposes of agreements by crews of fishing vessels previous to the passing of the Act of 1880, which practically made these agreements valueless, and not worth the trouble of going to the shipping master for. This Act, which came into force on the 2nd of August, 1880, was intituled "The Merchant Seamen (Payment of Wages and Rating) Act, 1880." The very title of this was misleading as to its true contents as a whole, and it did not appear on the face of it to affect the fisheries in any way. Notwithstanding this the question was asked, and a decided answer was given by the Board of Trade (by whom the Bill was introduced) that it would not affect the fisheries. The Bill was hurriedly pushed through at the end of a session and became law before the fishing trade had been consulted in any way or were aware of its real contents or objects. As this Act has done much injury, both morally and pecuniarily, to the fishing industry, it will be necessary to deal with it at full length, and

Act of 1880.

explain why and how it has so injured the trade which had previously got along pretty well.

Allotments.

The first clause which would affect fishermen, had it not been entirely set at nought by them, would be section 3, subsection 1, which renders it illegal for any seaman to allot more than half his wages to his wife, or whoever he may have dependent on him ashore. Now in the case of fishermen this would be a very great hardship if it were enforced. For instance, a man goes to sea for standing wages, say fourteen shillings per week, and a share, the amount of which can only be determined at the end of a voyage. He possibly has a wife and three or four children, maybe more, who require the whole of this weekly money to maintain themselves. If the law were enforced, the man could only allot seven shillings per week, which in many cases would mean starvation.

Desertions.

There is nothing of particular interest to the fisheries till section 10 is reached, which relates to desertion and absence without leave. This, of all sections, is the most injurious to the fishing trade. The Merchant Shipping Act, 1854, in section 243, subsection 1, ordered that "For desertion he (a seaman) shall be liable to imprisonment for any period not exceeding twelve weeks, with or without hard labour, and also to forfeit all or any part of the clothes and effects he leaves on board, and all or any part of the wages or emoluments which he has then earned, and also, if such desertion takes place abroad, at the discretion of the Court, to forfeit all or any part of the wages or emoluments he may earn in any other ship in which he may be employed, until his next return to the United Kingdom, and to satisfy any excess of wages paid by the master or owner of the ship from which he deserts to any substitute engaged in his place at a higher rate of wages than the rate stipulated to be paid to him."

In subsection 2 it was ordered that "For neglecting or refusing without reasonable cause to join his ship, or to proceed to sea in his ship, or for absence without leave at any time within twenty-four hours of the ship's sailing from any port either at the commencement or during the progress of any voyage, or for absence at any time without leave and without sufficient reason from his ship or from his duty, not amounting to desertion, or not treated as such by the master, he shall be liable to imprisonment for any period not exceeding ten weeks, with or without hard labour, and also at the discretion of the Court to forfeit out of his wages a sum not exceeding the amount of two days' pay, and in addition for every twenty-four hours of absence, either a sum not exceeding six days' pay, or any expenses which have been properly incurred in hiring a substitute."

So long as this was the law, everything worked satisfactorily; but by the Act of 1880 the words in subsection 1, to imprisonment for any time not exceeding twelve weeks, with or without hard labour," were ordered to be omitted. Further, a clause was inserted as follows: "A seaman or apprentice to the sea service shall not be liable to imprisonment for neglecting or refusing without reasonable cause to oin his ship, or to proceed to sea in his ship, or for absence without leave at any time within twenty-four hours of his ship's sailing from any port, or for absence at any time without leave, and without sufficient reason from his ship or from his duty." Thus imprisonment for desertion by any seaman or apprentice was distinctly abolished.

Subsection 3 was also inserted, and runs as follows: If a seaman or apprentice to the sea service intends to absent himself from either his ship or his duty, he may give notice of his intention either to the owner or to the master of the ship not less than forty-eight hours before the time at which he ought to be on board his ship, and in the event of such notice being given, the Court shall not exercise any of the powers conferred on it by section two hundred and forty-seven of the Merchant Shipping Act, 1854." In subsection 2 of section 243 of the Act of 1854 the words, "to imprisonment for any period not exceeding ten weeks with or without hard labour, and also at the discretion of the Court," were ordered to be omitted by the 1880 Act. Thus imprisonment for neglecting or refusing to join or to proceed to sea, or for absence within twenty-four hours before sailing, and for absence without leave was distinctly abolished. Section 246 of the Merchant Shipping Act was repealed by this Act, which gave power to owners or masters and their agents to apprehend deserters without warrant. In section 247 the words, "instead of committing the offender to prison," were repealed, also section 248, which was a subsidiary section to 246. By section 11 the Employers and Workmen's Act was made to include seamen and apprentices, to whom this Act did not before apply. This Act permits a man to leave his employment at any time, but gives the employer the power to sue the employed for breach of contract and damages.

The foregoing are the principal alterations made by the Act of 1880, which bear on this question. The Act, as before mentioned, came into force on the 2nd August, 1880, and soon began to disturb the trade, and raise the question as to the use of indentures of apprenticeship, as an apprentice could desert without fear of imprisonment, and to sue him for damages under the Employers and

Workmen's Act was absurd, as all he possessed belonged to his master. The same applies to suing a fisherman for damages under this Act, as it is impossible for a man with no home or effects, as is generally the case with deserters, to pay even £5 damages, which would be a very small amount, considering that sometimes the average catch of the boats would be £50, or even more for one night. The trade, therefore, found themselves in a fix, and helpless. The consequence was, that within a month after the Act came into force, no one being able to understand its real object, the Board of Trade issued a notice endeavouring to explain it. The notice ran as follows :—

NOTICE.

Apprentices to Sea Service.

Merchant Seamen (Payment of Wages and Rating) Act, 1880.

"As some misapprehension appears to have arisen with reference to changes made by the Merchant Seamen's Act, 1880, in the law regulating the position of apprentices to the sea service, who may neglect or refuse their duty to their employers, the Board of Trade think it well to give a short explanation in the matter.

"1. In first place it is an error to suppose that the jurisdiction in such disputes is remitted to the county court. A reference to the Employers and Workmen's Act of 1875 (which by the present Act is made to apply to seamen and apprentices to the sea service) will show that it remains, as before, with any court of summary jurisdiction, that is, with the magistrates.

"2. It is true that the imprisonment of apprentices for 'desertion' or 'neglecting to join,' is now forbidden, but under the 6th section of the Employers and Workmen's

Act, when an order is made directing an apprentice to perform his duties under the apprenticeship, the Court may, if satisfied that the apprentice has failed to comply therewith, order him to be imprisoned for a period not exceeding fourteen days. It must further be noted that subsections 4 and 5 of section 243 of the Merchant Shipping Act, 1854, remain unaffected, and by these two subsections apprentices are still liable to imprisonment for wilful disobedience 'to any lawful command' or for 'continued wilful neglect of duty.'

"3. Although an apprentice, by giving 48 hours' notice under section 10 of the Merchant Seamen's Act, 1880, can protect himself from liability to be summarily sent on board by order of a magistrate, it may be contended that the very fact of his giving such notice constitutes *primâ facie* a violation of the indenture of apprenticeship, and exposes him to be at once taken before a magistrate in order that his case may be dealt with according to circumstances either under section 243 of the Merchant Shipping Act, 1854, or under the provisions of the Employers and Workmen's Act, 1875."

This is dated 3rd September, 1880.

Now the Act of 1880 distinctly abolishes imprisonment for desertion, and that this was fully intended cannot be gainsaid, and was mainly caused by the pressure of trades unions, as has since been admitted. Section 2 of the notice given above cleverly points out the way to evade this by showing that, notwithstanding the abolition of imprisonment for desertion, the apprentice is liable to not exceeding 14 days' imprisonment under the 6th section of the Employers and Workmen's Act for neglecting to perform his duties under the apprenticeship. Clearly deserting would not be performing his duties, therefore if an apprentice deserts and his master can catch him, he cannot imprison him for desertion, but by calling it by another name, viz., "neglecting to perform his duties," he can do so. This speaks for itself, and is evidently intended to show how to evade a blundering Act of Parliament. Another means of evasion is next pointed out by calling attention to subsections 4 and 5 of section 243 of the Merchant Shipping Act, 1854, whereby apprentices are liable to imprisonment for wilful disobedience to any lawful command, or for continued wilful neglect of duty. Therefore, again, if an apprentice deserts, it rules that a master may prosecute his apprentice for desertion by simply calling it by another name, either "wilful disobedience," or "continued neglect of duty," and this in the face of an Act stating that an apprentice shall not be liable to imprisonment for deserting or neglecting to join his ship. Section 3 of this notice then points out that although the Act of 1880 gives the apprentice power to give 48 hours' notice to protect himself from liability to be summarily sent on board by order of a magistrate, still, should any unlucky apprentice think proper to avail himself of this thoughtful and kind privilege enacted by the Act of 1880, he renders himself liable to be at once taken before a magistrate to be imprisoned because he has violated his indenture, by acting according to the law which empowers him to give this notice. It must be evident to any one that the effect of this part of the Act of 1880 has been to put the trade into a state of great uncertainty. At some ports the magistrates, acting no doubt under the advice of their clerk, have connued to imprison for desertion, by looking at it from the point of view set forth in the Board of Trade notice. At her ports convictions for desertion have not taken place, as masters, solicitors and magistrates' clerks could not see their way clear to bring forward desertion cases under another name. One thing is clear, that if it is allowable to imprison an apprentice, say 20 years of age, for desertion, it ought to be possible to do the same with his shipmates.

It will now be the proper place to prove the assertion made at the commencement of this subject, that of all sections in the Act of 1880 this is the one which has most injuriously affected the trade. In this trade expedition is of the utmost importance, owing to the extremely perishable nature of the fish, and other reasons. Shoals of fish may be on the coast one day and the next they may be entirely gone, no one can tell where, therefore, when the fish are on the coast, there should be nothing to impede the gathering in of the harvest. It will have been noted that the Act of 1880 applied to seamen as well as apprentices. Let the case of the drift fishings be taken first. An owner wants a crew for his boat, say eight hands, seven men and a boy. As a rule it is necessary that five of these men should have been to sea before, so as to be acquainted with their duties. These are got perhaps with difficulty, the other two are simply required for their main strength to heave at the capstan; therefore most likely the first able-bodied men who offer themselves will be shipped; but as this is a peculiar calling, and only a job of short duration (at all events on the east coast), perhaps for only six weeks, or it may be three months, men cannot be found, for the demand is greater than the supply. Therefore at the various seasons there is an influx of tramps to these fishing ports, glad to accept almost any offer, so as to get a meal, and as a rule almost naked. These men get the berths where no nautical knowledge is required. But before they can go to sea they must be provided with suitable clothing, for fishing is not like taking a labouring job ashore, it is a calling in which a man is compelled to be exposed to wind, rain, and weather night and day, and therefore must be clothed accordingly. Then the question arises, what is to be done? The owner wants the man, the man wants the job and clothes, or at least sea boots and oily clothing. The only way out of the difficulty is for the owner to provide the necessary clothing at his own risk, and agree with the men, who as a rule are entire strangers to him, that when they settle up at the end of the voyage the value of the clothing so supplied shall be deducted from the share which may be due to them. At some ports the outfitters will supply clothes to men of this class at their own risk, but on the understanding that if the man to whom the clothes are supplied deserts, or does not pay for them, the owner shall bear half the loss by paying half the amount to the outfitter. These strangers, being thus provided with sea clothing, do not always proceed to sea, for it sometimes happens that, if from bad weather or other cause, the vessel does not leave the port on the day expected, the men being in possession of this new clothing, desert, either pawn or sell it for a trifle, and are possibly not seen or heard of any more. Perhaps the vessel proceeds to sea as arranged, the owner having fitted out these men at the last moment with the clothing, and returns to port in one, two or three days; the men either don't like the sea, want money, or for some other reason of their own desert and dispose of the clothes, as before mentioned. It would be the exception if sufficient money were due to them after making one trip only, to compensate the owner for the clothes, because where vessels sail by the share, as these craft usually do, the provisions, salt, &c., are a first charge on the gross earnings. If it should so happen that the vessel makes a good commencement of the voyage, and the men have money due to them, desertion would be an exceptional thing. Under the Act of 1854 these desertions did not often take place, for the would-be deserter had the law against him in the form of liability to three months' imprisonment with hard labour; but by the Act of 1880 this was done away with, and the only remedy an owner now has is to sue the deserter for damages for breach of contract. If he takes the clothes which the owner has provided him with, he must be sued in the county court, as it is not a case of theft theoretically (though it is practically), but a case of debt. It must be clear to any one that to sue a man for damages who has no home and no property but what he stands in, would be absurd Thus owners have since 1880 been without any practical remedy against those of their crews who, for their own whims and fancies, desert at any time, no matter what document they may have signed or agreed to. This law applies to the crews of all classes of fishing vessels, and the crews have at present the mastery in this direction. The losses to owners from this cause having assumed such large proportions, the President of the Board of Trade consented to receive a deputation of representatives from various fishing ports to hear their views of the matter; 156 instances of desertions were brought forward, and these were only a small portion (as typical cases), and the estimated amount of loss from these incurred by owners was £2648. The views of the deputation were expressed, and the President then put forward as an argument, that if his gardener left him he should not think of imprisoning him, he should immediately get another; or, as another argument, that when he employed 2000 or 3000 men, if there were any who did not wish to remain in his employ, he told them by all means to leave if they wished to do so, and he could not understand the idea of compelling a man to remain in his service. Now this is all very well where a garden or a factory is concerned, but in these cases the employer does not find provisions for his men nor yet clothes, as the owner of a fishing vessel is compelled to do before they begin work or he knows anything of them, or else to give up his business for want of hands. Again, the insinuation by the President as to the insufficiency of the pay of fishermen has no *locus standi;* for, as has been explained previously, the vessels sail on the share system, and the more money the crews earn the more they receive. A more equitable arrangement than this could not be made even in a factory. In a very successful voyage of six months a boy's share has been known to amount to over £30, exclusive of his food. It would not do either to pay these crews by the week, as the calling is totally different to that of men at work in a factory, where they can be overlooked. A fisherman when at sea is free from supervision, and, without some incentive to persevere in the shape of participation in the profits, would in many cases ruin the trade. The arguments given above, advanced by the President of the Board of Trade, will show how difficult it is for a department to legislate for a trade, of the general working of which it is ignorant, and much more so of the details, and shows plainly that it ought to be able to command the advice of practical men thoroughly conversant with all details. The question naturally arises, why was the law altered, as there were no complaints from the trade nor any notification that a change was desired in any way? The answer is at present a mystery. The trade was in no way consulted, and to satisfy the whims or fancies of somebody, a trade that was working comfortably has been upset, and thousands of pounds have been lost to the country, the owners of fishing craft and even the fishermen themselves as a body, for whole crews do not desert. It is as a rule some idle or ill-disposed man who deserts, and by his desertion prevents seven or eight industrious men who want to go to sea and earn their living from so doing. If the law were altered because some one considered that it was hard on the fishermen, he made a great mistake, for it has caused many a poor but respectable and hardworking fisherman to lose many pounds through the desertion of one idle man, whereas under the old Act an idly-disposed man would have been compelled to go to sea and keep his contract. Another fact must here be noted, that although previous to 1880 a fisherman could be arrested without warrant, no statistics can be produced which will show that the power given to owners was abused; on the contrary, if statistics were produced, it would be found that out of the men arrested, or threatened with arrest by a police-constable for desertion, or refusing to go to sea, by far the larger proportion have gone to sea, either on being threatened, or advised to do so by the magistrates before whom they were taken, a few only going to prison. In some cases where they have gone to prison they have frankly admitted that it was for some purpose of their own, or that they might alter the commencement, and consequently the termination of their voyage. No owner ever wished to send any of his crew to prison when they had done nothing criminal, for that would be no benefit to him, his great object being to obtain their services by compelling them to fulfil their contract; which is only just, for if a deserter can bring forward a good cause for his desertion no magistrate will ever send him to prison. A few alleged reasons for deserting may here be given. Incompetency of master, mate, or of some member or members of crew; disease of some member of crew; state of berths or cabin; leakiness of vessel; hard working of capstan; gear not in proper condition, rotten or insufficient; sails rotten; master will stop at sea in bad weather; drunkenness; going to sea on Sunday or not doing so; mode of sharing; boat not equal to others; made a bad commencement of voyage, and got into debt for provisions; lost nets at commencement of voyage; want holiday or spree; don't like the calling, find it too rough; are tempted away by a better offer either of wages or vessel; don't like being cook; fear; object to salesman; to extort higher wages; are used as catspaws to keep out of the way at sailing time when others of crew don't want to go to sea. The last two demand some explanation, as they are frequent causes. The former occurs at tidal harbours where, if a vessel does not get to sea at a certain state of the tide, it will be useless for her to sail till the next day, or when there is a glut of fish and hands are scarce. For instance, an owner has his vessel ready for sea, very likely a trawler, where the hands, or some of them, are receiving weekly wages. A tug is engaged to tow the vessel to sea at tide time. When almost the last moment arrives, a man (more frequently two) steps ashore and says, "Owner, we shan't go unless you give us (say) two shillings a week more wages." The owner is thus placed in an awkard predicament, he knows that if he does not agree to the demand he will not be able to get hands in their places before the tide is done, therefore, rather than lose a night's fishing, which would be a much heavier loss to him, in most cases he concedes to their demand. The latter case is when a portion or perhaps the whole of the crew, for whims of their own, have made up their minds that they will not go to sea for a day or two, very likely to entice them to stay ashore for a drunken spree. Two of them will agree to keep out of the way (or sometimes lots are drawn for this) when the vessel is ready for sea again. The remainder of the crew agree to stand by them, so that if the owner or master exerts himself, and obtains other hands, the other part of the crew will refuse to go with strange hands, alleging that they are not used to the vessel, incompetent, &c.; thus absentees may sometimes be seen watching the vessel from some coign of vantage, enjoying the mortification of the owner or master, who may have obtained men to supply their places, and treating the whole affair as a good joke. A rejoinder to this complaint may be that under subsection 7 of section 243 of the Merchant Shipping Act, these men are liable for conspiracy to twelve weeks' hard labour, but practically it is useless, as it is very difficult to prove the conspiracy though well known. Under the old Act the men now used as catspaws would not do this, for fear of being arrested without warrant or any red-tapeism, and walked off to prison; but the abolition of the old Act by that of 1880 has encouraged this practice, and rendered owners practically powerless. The great difficulty in this question is that the demand for hands is greater than the supply, and the nearest industry (though there are wide differences) to which it may be compared, is the hop-picking in Kent, in which the hop-growers have a yearly influx of the riffraff of the East of London, whom they are compelled to employ for want of better hands. So it is with the fisheries, and this shows how useless is the argument put forward, that owners should employ a better class of men. To some sharp-witted tramps and loafers this Act has opened a means of living in comparative comfort for months together; for, having got to know that for desertion they could only be sued under the Employers Act, some of them have shipped to vessels without number, living on board till the vessel is ready for sea, then deserting and shipping to another. When they begin to get too well known at one port they tramp to another, and play out their game there, repeating the same yearly as the voyages come round.

The remedy provided in the Act of 1880 for conveying a deserter on board was well meant but is practically useless, for this reason, that when the deserter is found he can claim to be taken before the court, which he would do on principle, with a view of defeating the attempt to convey him on board. This means delay, especially in ports where the magistrates sit weekly only, and this delay renders the remedy useless. If the Government will not re-enact the old law, the only remedy will be to provide means for the immediate issue of warrants for the arrest of deserters and the imposition of a fine, or in default imprisonment, though this will not meet the case as the old law did; for if a warrant can be obtained in a quarter of an hour only, it will give deserters a good chance and encouragement.

Lights.

The question of Lights is most important and has been the subject of special enquiries. The Sea Fisheries Act of 1868, which embodied the convention of 1867, ordered that a drift fishing vessel should carry two white lights, one over the other, three feet apart, between sunset and sunrise, when the nets were shot. This was not carried out by France, and consequently was not generally observed by English vessels. The Sea Fisheries Act, 1875, supervened to direct that nothing in the Sea Fisheries Act, 1868, should be considered to repeal or alter the regulations of the Merchant Shipping Act, 1862, under which the Order in Council of 1863 was made. There were thus three Acts directly bearing on the question of lights, and in consequence the greatest ignorance prevailed as to the proper lights for drift vessels. Trawlers everywhere were, and have ever since been in the habit of carrying a white light at the masthead when at work. To set this right, a joint committee was appointed by the Admiralty, Board of Trade, and Trinity House, without consulting the fishing interest in any way, to draw up fresh regulations for fishing vessels' lights. These were adopted by Austria, Belgium, Chili, Denmark, France, Germany, Great Britain, Greece, Italy, Netherlands, Norway, Portugal, Russia, Spain, Sweden, United States, and other smaller states, and were directed by an Order in Council dated 14th August, 1879, to come into force on the 1st September, 1880. They were briefly as follows: that a drift-boat at work should carry on one of her masts two red lights in a vertical line, one over the other, not less than three feet apart. A trawler at work should carry on one of her masts two lights in a vertical line, one over the other, not less than three feet apart, the upper light red, the lower green, and should also carry the usual side-lights for sailing vessels under weigh. On this becoming known to the fishing trade, meetings were held strongly condemning the proposed system, and memorials addressed to the Board of Trade from the principal ports asking for a reconsideration of this proposed system, whereupon the then President of the Board of Trade appointed a committee consisting of three gentlemen, no doubt very able in their own particular way, but, as was at the time admitted by each, totally unacquainted with the practical duties of fishermen or the working of their vessels.

In reply to questions put to them when being examined by the select committee afterwards appointed, one gentleman said he had no experience whatever as regards fishing in trawlers or drifters. The second said, that not being a sailor he could not answer nautical questions. The third admitted that he had not been in fishing vessels, and that after the evidence had been received he had taken no further interest, as he had other occupations, but signed the report as drawn up by the gentleman from the Board of Trade after he had "*run it over.*"

And yet it is given in evidence that these three gentlemen were appointed by the President of the Board of Trade as a committee of experts. What a delusion! and what a careless way for a Government department to deal with a matter affecting such momentous interests, involving the risk of thousands of lives and enormous property! These gentlemen visited various ports, and informally enquired of persons interested in the fisheries the grounds on which they had based their objections to the new rules.

They reported that they saw no reason whatever for recommending any delay in enforcing the proposed regulations. In one portion of their report they said: "The first and most important ground of objection they (*i.e.* the trade) urged is costs," and yet further on the committee remark: "We wish to place on record our testimony that the vessels employed in these fisheries are for the most part exceedingly well kept up, that the owners and those having the management apparently desire to make them in every way efficient for their work." Can it then be supposed, after thus testifying to such a great desire for efficiency on the part of owners, that, to complete this efficiency and make more secure their property (which is never fully insured) and the lives of their crews, they would cavil at the cost of even four extra lamps, if they could see it would be an extra security, of which from their practical knowledge and experience they certainly ought to be the best judges? In consequence of continued opposition, and notwithstanding the recommendations of this committee (which stated that they saw no reason for delay), which were made on the 19th February, 1880, a supplemental Order in Council was passed on the 24th March, 1880, putting off the coming into force of the objectionable part of the proposed regulations till the 1st of September, 1881, instead of September, 1880, as originally proposed. On the 25th May, 1880, it was ordered "that a select committee be appointed to enquire into the objection urged by persons connected with the fishing industries against the new regulations as to lights for fishing vessels." This committee was nominated on the 1st of June, 1880, and consisted of thirteen Members of Parliament, who held a most exhaustive enquiry at twenty of the principal ports of the United Kingdom, and who on the 14th July, 1880, recommended that trawlers should be allowed to carry one white light, as they always had done, and that drifters should be distinguished by two white lights. In consequence of the difference in the reports of these two committees the original Joint Committee was reappointed, and on the 5th January, 1881, they agreed that drifters should carry two white lights, and that trawlers should carry a red light at the foremast head and a white light in any position in the after part of the vessel where it can best be seen. In consequence of continued opposition, and questions being asked in the House of Commons, the Joint Committee met again on the 30th March, 1881, and confirmed their immediately previous recommendation. Thereupon the Board of Trade wrote to the Foreign Office asking them to ascertain from the Governments of France, Belgium, Holland, Denmark, Germany, Norway and United States, what their views were on the subject generally, and especially upon the question, whether the distinguishing light of a trawling

-vessel when at work should be a single white light, or a red light at the masthead, with a subsidiary white light shown aft anywhere above the gunwale. A similar circular to the same effect was addressed to shipowners and others. Now it is hardly to be credited, but it is a fact, that the shipping department of the largest maritime power in the world issued these circulars to foreign powers and shipowners, asking their opinions on two proposals for a system of trawlers' lights, respecting one of which they had never ascertained whether it could be adopted. They sent out the circulars first, and afterwards heard that one system could not be practically adopted (viz., the white light above the gunwale aft). To these circulars 116 answers were received, 46 were for the white light which has been in use from time immemorial, and 70 in favour of the masthead red light and a white light aft above the gunwale, which is impracticable. Since this a fourth proposal has been made to the departmental committee, to the effect that trawlers at work should carry a red masthead light 6 feet vertically over a white one. This, again, to any one at all acquainted with trawling shows an almost incredible amount of ignorance. All the time this question has been in course of discussion the periods for the coming into force of the proposed legislation have been staved off by Orders in Council through the Board of Trade, and as matters now stand, no alteration can be made till 1st September, 1883. This brief allusion to the lights question will show that, however willing and anxious a department may be to legislate for the benefit of this most peculiar trade, it cannot do so successfully and beneficially without first consulting and securing advice from persons who have practical knowledge of it, whether ashore or afloat. One nautical gentleman who was concerned in one of the committees, on being shown a trawling smack, asked the question, "Where are the yards?"—things entirely unknown in our English trawlers. Again, when the latter part of article 7 of the existing Regulations is considered, which runs as follows: "Fishing vessels and open boats when at anchor or attached to their nets and stationary shall exhibit a bright white light," how absurd it appears; for what craft are there that are ever stationary when attached to their nets? for even in a calm a trawler will have her gear at her side, and a drifter will be drifting with the tide; it would only occur in the exceptional case of a trawler fast to a wreck or rock or otherwise; and this article is the only one referring to fishing vessels, and was evidently intended originally to apply to them when at work and practically helpless. It was evidently meant to convey that all vessels under command must avoid them. There can be no doubt that many a fishing vessel has been run down and sunk from either of the following causes: 1st. The frequent practice of ships trying to get close to fishermen to ascertain the bearings of the nearest headland, and in doing so running them down. 2nd. The practice of many steamers not altering their course till the very last moment, and driving against time in thick or clear weather; as it frequently occurs that when masters of steamers make slow passages, they are politely informed that their services are no longer required, and so they are virtually forced to this driving—"It is not compulsory only they must." When these go-a-head steam vessels are required to answer smartly to their helms, they will not always do so, and the consequence is that the fishing vessels get sunk and no more heard of. If these two practices were given up, fishermen would run considerably less risk of collisions. As regards look outs there are both good and bad on board all classes of vessels, this to a great extent depending on individuals and circumstances. A point which was overlooked, when the lights question was under consideration, was the manner of the working of foreign trawlers. It was shown in evidence as regards the pointing of an English trawler's head, how that in a light wind she would hang off the wind more than in a breeze, but it was not shown, how that foreign trawlers, as a rule, trawl bodily to leeward for various reasons, one alleged reason being that they catch more fish of the skate tribe, by so doing, than of the fish known in this country as "prime," the former being highly prized on the continent. Therefore, in this case, the pointing of a vessel's head would be at a right angle to the direction she was moving in, making the use of side lights (as proposed) more deceptive than in the case of English trawlers. There can be no doubt but that the system of one white light for trawlers, and two for drifters, as has been in use for many years, without any extraordinary number of collisions, ought to become law. Since these new regulations have been staved off from year to year, special notice has been taken of all casualties to fishing vessels, and no unusual amount of these can be brought forward to show that these lights are dangerous, or that any change is required. Pilot cutters, which number only about one to every hundred fishing vessels, should carry a red and a white mast-head light, to correspond with the colours of the flag they fly in the day-time. One white light would then have for its signification, a vessel with one net, or trawler; two lights would signify a vessel with more than one net, or drifter. It is only too true that in some cases both pilot cutters and fishing vessels do not trouble themselves to alter their working lights and carry their proper side lights when not at work. They may sometimes be seen actually running into port under their fishing or piloting light. These cases ought to demand the special attention of cruisers and port officials, and should be followed by heavy penalties. But it has been asked, Why can pilot cutters carry two mast-head lights when it is argued that smacks cannot do so? It is answered in this way, that pilot cutters are always free agents, can cruise about or lay to as they like, and are not subject to the quick and sharp motion of a trawler towing her heavy gear along.

Trawlers *versus* drifters.

Next for consideration is the effect of the laws as regards trawlers and drifters when at work, but it must be brief, as a Convention was signed on the 6th of May 1882 at the Conference at the Hague. This awaits ratification, and will in some points materially alter the present unsatisfactory state of things. Suffice it therefore to say that up to the present time the law has been very onesided, and in favour of the drifters, and ofttimes the owner of a trawler has paid to a drifter for damage done to nets a claim which he did not consider just, rather than go to court with the matter, knowing that the law would be interpreted against him. The law as it now stands says, "Trawl boats shall not commence fishing at a less distance than three miles from any boat fishing with drift nets, or having shot their nets shall not come nearer to such boats than the distance above mentioned." This is immediately after qualified by the following: "No boat fishing with drift nets shall shoot its nets so near to any other boat which has already shot its nets on the fishing ground so as to interfere with its operations." This being now on the eve of repeal it is not worth while to discuss it further. The law which is proposed in place of it will be dealt with further on.

ꞩent law regarding the settlement of salvage and ɪses is not satisfactory. At present the County ;es and the Justices of the Peace have concurrent ɪ. These are assisted by nautical assessors, sually wholly unacquainted with fishing from a ›oint of view. It would be much better that d be a fishery authority at each port, with power assessors who are practical fishermen, and who chosen, as far as possible, from all branches of ry, viz., trawl, drift, and line, and take these ıatters quite away from the County and Magis- rts, but giving power to appeal to a higher Court. l then be dealt with summarily and practically. **Salvage and damage.**

ct of the present law as regards the lettering :ring of boats would be good, if it were carried entirety. But it is not. It would be far better ĸtended to all shipping for purposes of identifica- es of damage, disaster, or foundering. At least all uld be compelled to have their names painted on the bow, not in their eyes, as is now frequently vhere it cannot be read from a broadside view. desirable that two-ended or duck-sterned boats e their names and ports painted on uniformly, e name of the vessel on the port side, and the ıer port on the starboard side. It does not :h which way it is, provided there is uniformity, nay be always known on which quarter to look ›ective names. **Letters and numbers.**

hod of shipping and making of agreements with hing vessels having already been fully explained, necessary to remark that the effect of the law ›int is practically nil, and, in fact, that as the 'o gives power to a man to break his agreement **Agreements.**

after he has made it, the making of agreements has been virtually abolished, and entirely new legislation is required for this. This will also apply to the indentures and binding of apprentices.

Orders in Council.

Under the present law power is given for orders in Council to be made at any time, which shall alter and revoke regulations which are law. The effect of this has been to harass the trade in several instances, through these Orders in Council having been issued at the instance of a department totally ignorant of the requirements of the fishing interest. Take a couple of instances only. The Order in the Council made on the lights question. As soon as a Select Committee was appointed to report on it, it was instantly condemned. The Order in Council directing that all decked fishing boats should have on board the same cubical accommodation for their crews as is directed to be provided for the crews of cargo ships. As has been pointed out, had this been enforced, there would be no space left on board a fishing vessel for the necessary gear and stowage required. This power should no longer be allowed to exist in face of the absurd and injurious results it has produced.

Mortgages.

Some amendment in the present law of mortgaging fishing vessels would be desirable, with a view to prevent the frauds which occur from time to time under the present law. More publicity is required, so that the real interest which a reputed owner has in a vessel may be ascertained more readily than by searching the Custom House register by fee. It sometimes happens that two men agree to purchase a vessel, but yet not risk all the capital invested, so one takes the place of mortgagee to a large amount, the other the place of registered owner.

Gear and stores are then ordered by the registered owner, and it frequently occurs that he becomes insolvent, either in form or in reality. The mortgagee then seizes the vessel and obtains the benefit of all the gear and stores put on board by the reputed owner. In a drifter's case, more especially where the nets are constantly being changed, the mortgage may have been made when there were a lot of old nets on board, and the vessel seized with a fleet of nearly new nets, which have been obtained by the reputed owner, though no one can prove it. Thus a facility is offered to unprincipled men to embark in the fishing trade without risk of much or even any loss, the merchants and tradesmen having to suffer. Gear ought, therefore, to be excluded from mortgages. Another point is that some more easy method is required of recovering moneys due to crews, in cases where a salesman is mortgagee. It sometimes occurs that a master of a boat makes a good voyage; he is then offered a vessel to work out at a high price by the salesman, on his investing the results of his good voyage. The offer is usually jumped at, even if the price is high. The next voyage does not prove so successful, and perhaps the owner finds himself unable to meet his creditors. The salesman, who is also mortgagee, holds what moneys the fish caught during the voyage have realised, looks after himself and retains this money on account of his mortgage, the mortgagor being possibly under an agreement to that effect. When the crew look to the owner to settle up, he has no money for them. The matter then turns to a complicated point of law, which fishermen, as a rule, are not able to go into, and the consequence is they lose their earnings. The legal points are, as to the relation the salesman bears to the crew, who are generally by the share, and thus partners, but yet have had nothing to do with the appointing of the salesman, who has virtually appointed himself, by reason of his mortgage. The salesman ignores them, his bargain being with the owner, and tells them to look to the man with whom they made their bargain. Then, as they virtually occupy the place of partners in profits, they must share with the creditors for provisions and stores, unless they are receiving *bonâ fide* wages, to enable them to have a first claim on the vessel and gear. This peculiar relation of crews by the share to owners and salesmen requires a good deal of consideration and discussion before legislation can be made, but it may be suggested that in the agreement made (when such are legalised) the salesman should be appointed by all those who stand in the place of sharemen or partners, and that the salesman should acknowledge this by also signing the agreement. The peculiarities of this trade are isolated, extraordinary, and quite out of the usual course of shore or shipping business, and therefore require isolated and extraordinary legislation to meet them.

International Convention.

Having shown the effect of the present law, it will be right to consider the proposed legislation, and how it will affect the fisheries, if carried out, commencing with the convention signed at the Hague on the 6th of May, 1882, by the plenipotentiaries of the various powers, but awaiting ratification.

There is nothing which requires discussion till Article 8 is reached, which reads as follows (subsection 1): "The letter or letters and numbers shall be placed on each bow of the boat eight or ten centim below the gunwale so as to be clearly visible. They shall be painted in white oil colour on a black ground." This would have been better had it stated that the letters shall be placed on "the luff of the bow," instead of simply "the bow" of the boat. As it now stands the Dutch bomschuits are at liberty to so place their letters and numbers that they can only be seen from a point dead ahead instead of from a point on the broadside by a vessel sailing past. The ordering also of these letters and numbers to be placed three inches below the gunwale is a waste of space, and often makes them smaller than they need be.

Section 2 orders that, "The distance above mentioned shall not however be obligatory for boats of small burden which may not have sufficient space below the gunwale." Even then many vessels of over fifteen tons burden would not be able to conform to the next section, which orders that vessels of this tonnage shall have letters eighteen inches high and 2½ inches wide. Therefore it would have been desirable to insert a clause which would exempt such craft as these, but which would clearly order that in the event of larger vessels not being able to have their letters and numbers of the size ordered, they should have them painted on to the full extent of the bulwark. The same exception and proviso should be added to the next section which deals with vessels under 15 tons burden.

Fancy letters and numbers should be forbidden, and plain only allowed. Vessels' sails which are dressed with a mixture containing yellow ochre should be ordered to have the numbers painted on in black; letters and numbers in white on this class of sail being often almost illegible. Also, after each dressing or tanning, the numbers should be repainted.

The next subsection which orders the letters on the sails to be immediately above the close reef would have been better had it stated that they should be painted two-thirds of the distance from foot to head of sail on the leech, the distance to be calculated on, and the letters or numbers commenced from the second cloth from the leech of the sail and to be painted on at right angles to the cloths, and the number on one side of the sail to be immediately below that on the other, the measured distance of two-thirds of the sail being the centre (Fig. 1, red), as very often when numbers are painted one over the other, though on opposite sides of the sail, they show through and cause both sides to be an illegible mass (Fig. 2). They should also always be put on so as to read from right to left, as, sometimes, they are simply painted over on one side, the reverse of the other, to save trouble. If these suggestions were carried out the number would always be in one prominent position, and not on all parts of the sail, depending on the reefs, which vary so much in different classes of vessels; and in the case of vessels in a heavy sea would be discernible, whereas, if it were as low as the close reef most likely it would not be. A Dutch bomschuit has only two reefs of three feet each in her mainsail which is about forty feet on the leech, so that if the number was only placed immediately above the close reef it would be only nine feet from the deck instead of about thirty feet under the above proposal. The same also applies to a great extent to French *chasse-marée* trawlers; as well as to many of our own lug-rigged fishing vessels. The fashion now is to have only one reef in the foresail and that would be about six feet from the deck. If more reefs are required the large mizen is set on the foremast and the second or drift mizen on the mizen-mast. This class of vessel has no mainsail, and so, strictly speaking, is not included in the Convention. This is another practical omission, as it leaves it optional for luggers to have their letters and numbers on foresail or mizen, which should not be. There is here also an omission to provide against

FIG. 1.

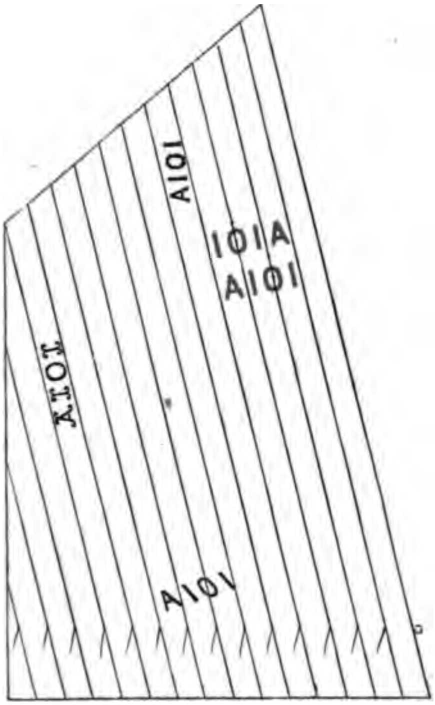
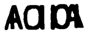


FIG. 2.



a constant irregularity, which occurs among fishing vessels in this respect; it is this: Fishing vessels frequently damage their mainsails, and out of such a large number of vessels this must frequently be expected. The rule in this case is not to lose time by waiting for it to be repaired, but to borrow a sail either from the sailmaker's, or a fellow-owner, or, where an owner has two or more boats, to substitute a sail belonging to any other of his boats which does not happen to be in use. This sail of course is numbered, and this number does not agree with the number of the boat borrowing it, therefore, under present circumstances, she is acting illegally by going to sea in this manner. It would be impracticable to alter these numbers as often as this occurs, therefore, to enable a vessel of any nation legally to proceed to sea under these circumstances, the master or owner of such vessel should be compelled to apply to a proper officer for a permit, which should be issued with the particulars of the cause of its issue stated on it, and a copy should be retained by the officer. It should be granted for a reasonable time, according to the nature of the cause, and it should be compulsory for the master or owner to deliver it up at the expiration of the time, or as soon after as the vessel returns to port, under a penalty. It should be renewable, if required, on reasonable grounds, or, if the cause of it is removed before expiration, immediate notice of same, with return of permit, should be given by the owner or master. Then, in case of damage or offence, the vessel could be easily identified, or in the case of a cruiser overhauling her, under Article 27, the master could produce the permit to show that he was acting legally. This suggestion should extend to any portion of the gear in a certain manner, as nets are sometimes borrowed in cases

[illegible]

of heavy loss, or several boats which are not his own may be netted by one man, and consequently the nets and bowls will be marked differently from the boat using them.

Article 11 contains an expression which is unknown in fishing terms, it is the "principal floats." It is presumed that either the netshead corks, or bowls, are intended, but it would have been better if it were clearer, as it would puzzle any practical fisherman.

Article 14 orders that "no fishing boat shall anchor between sunset and sunrise on grounds were drift-fishing is actually going on," this prohibition "shall not, however, apply to anchorings which may take place in consequence of accident or compulsory circumstances." Now, suppose a vessel in a calm anchors because there is not wind enough for her to get where she wants, and no drifters are in sight or near for miles, but during the night a drifter's lights are seen a mile or more distant on either bow, and the vessel at anchor judges that the drifter's nets will go clear of him, but makes an error in so doing, and the poll end portion of the drifter's nets foul him, who will be responsible for the damage? This is applicable also to a great extent to buoys laid down by telegraph ships. It is a question for argument as to whether it was compulsory for the vessel to anchor, or the telegraph buoy to be laid, and in the event of it being proved that such anchorage was not compulsory, the plea can then be put forward that when such anchorage took place no drift-fishing was actually going on. The words "grounds where drift-net fishing is actually going on" are very indefinite; if construed broadly they mean the whole North Sea, at certain times and places, but if narrowly construed, they are of no value, for no vessel would anchor or telegraph ship lay a buoy where the drifters could be seen already fishing and driving down on them.

As before mentioned, in the present law there is a ualification of one article by another in the case of trawlers amaging the gear of drifters or longliners, so in this onvention, Article 15 on the same point is qualified by rticle 19. The former orders that "Boats arriving on the hing shall not either place themselves or shoot their ts in such a way as to injure each other, or as to inter-re with fishermen who have already commenced their erations." The latter orders that: "When trawl fisher-en arrive in sight of drift-net or long-line fishermen they all take all necessary steps in order to avoid doing injury the latter. Where damage is caused the responsibility all lie on the trawlers, unless they can prove that they ere under stress of compulsory circumstances, or that the ss did not result from their fault." Thus, if a trawler has ot his gear and a drifter afterwards arrives in the same cality and shoots his nets, so that there is a likelihood of eir becoming foul of the trawler, this latter vessel is bound y Article 19 to take all necessary steps to avoid doing jury to the drifter, which, in most cases, means to haul up er gear, and take herself off and suffer a loss, and yet, by rticle 15, the drifter has broken the law by arriving on e ground and shooting her nets in such a way as to terfere with a fisherman who has already commenced is operations. The protection given in Article 15 to a ssel which has commenced operations holds good in the se of a drifter, but in the case of a trawler it is rtually withdrawn by Article 19. This is obviously njust, and open to much argument in case an action for amages is brought by a drifter against a trawler. Or, ppose a foul occurs in hazy weather, the question of amages under Article 15 of this Convention resolves elf into the time at which either vessel shot its gear, the one which shot last being the responsible one.

The different classes of vessels often want to work the same ground, as where herrings are there are generally bottom fish, especially soles, when the herrings are spawning, as they are greedy fish for herring spawn as food. It has been suggested that the sea should be mapped into districts, but the difficulty would be to prove in cases of claims for damages (which generally occur at night) as to which vessel was in her right district. And again, it is well known that during some seasons the drift fish will lie near the coast, at others many miles have to be traversed before the shoals of fish are reached, so that practically it would be necessary to map off the greater part of the sea for the drifters during the greater part of the year, which would not be practicable. If trawlers are to be compelled to give way to drifters, even though they are fishing before the drifter or longliner arrives, surely some sort of compensation ought to be recoverable by a trawler from a drifter or longliner which compels him to haul his gear and lose his time. Again, in Article 20 it is ordered that, "when nets belonging to different fishermen get foul of each other they shall not be cut without the consent of both parties. All responsibility shall cease, if the impossibility of disengaging the nets by any other means is proved." Therefore, if a trawler, who shot first, gets entangled with a drifter, the trawler will not break the law any how, if he cuts the drifter's warp, as this is not mentioned in the article; and having done this the net rope would break and the net tear through, and the trawler would get clear, and could in this case plead that the loss sustained by the drifter did not result from his fault under Article 19, and that the nets could not be disengaged by any other means than cutting the warp of the drifter under Article 20, or even that he did not cut the drifter's "nets." If Article 20 had the words "fishing gear," inserted instead of the word "nets," it would be much less open to controversy. In moderate weather it is often possible (and has been done many times), for a trawler, when foul of a drifter's fleet of nets, to cut the drifter's warp, unbend at the nearest net's head, pass the ends of the drifter's warp on either side of his rigging, knot the warp (or even splice a piece in, in some cases), and thus pass through the drifter's nets with a minimum of damage. But this has not been done by trawlers in many instances where it would have been possible for them to do so, owing to the feeling that the trawler had as much right there as the drifter, and that he must take the consequences.

Article 16 appears to be clear in section 1 and 2, but section 3 is not quite so clear as it might be; it runs as follows. "As a rule if decked boats shoot their nets to windward of undecked boats which have begun fishing, the responsibility as regards any damages to nets which may result, shall rest with the boats which last began fishing, unless they can prove that they were under stress of compulsory circumstances, or that the damage was not caused by their fault." This is a very easy way of getting over a difficult question. What is implied by the first three words, "As a rule?" To say the least of it, they introduce a doubt into the question at once. Again, what is the definition of compulsory circumstances? Who is to decide it? Our justices, and county court judges are ignorant of these matters, and nautical assessors are not, as a rule, practical fishermen. There are eddies, and sets of tides in various places, which will set fleets of nets together under certain circumstances in spite of any efforts to prevent them. These and other peculiarities are only known to practical fishermen and if it is left open by the law as to what "compulsory circumstances" are, and non-practical men are called upon as assessors to decide, it is impossible for justice to be done in cases of dispute. Again, suppose a boat either decked or undecked arrives on the drift grounds where the fish are shoaling, and cannot find a berth, except by shooting contrary to Article 16, whichever way it may be, and a foul occurs, would these be considered "compulsory circumstances," or is the boat which is unable to find a berth to be condemned for not having kept its nets in board? Again, it sometimes happens that boats, through light winds or other causes, do not arrive on the grounds before dusk or dark, who is then to decide as to which boat commenced to shoot first? It would have been better if some clause had been inserted stating which vessel should be the one to go to work first, in the event of two fleets of nets getting into close proximity and rendering a foul probable, and specifying a certain distance, for it sometimes happens that a small decked lugger which has shot first is compelled to haul for fear of a larger craft (perhaps with steam capstan) which shot after her, and is drifting down on her; as a foul with the larger craft means the same result for the smaller one as a collision between a private carriage and a goods waggon. It will not be out of place here to remark that the Convention makes no provision for signals to be displayed by fishermen to summon a cruiser to their assistance. These cases of damage nearly always occur at night, when the cruisers cannot see the vessels, and if authorised signals could be made by a fisherman for the assistance of a cruiser, in cases of collision of gear or damage, it would have a certain deterrent effect on the wrong-doers, as they would never feel sure whether, on the signal being shown by the aggrieved boat, a cruiser might be near, and come to the rescue. The cruisers should also have certain districts assigned to them, so that they may be spread about the grounds as much as possible, lying to, or, moving as little as possible during the night to avoid damaging the drift nets. Article 21 is as follows: "When a boat fishing with long lines entangles her lines in those of another boat, the person who hauls up the lines shall not cut them, except under stress of compulsory circumstances, in which case any line cut shall be immediately joined together." There is here simply a provision as to what is to be done after long lines have got entangled, and the words, "compulsory circumstances" are again used without any attempt at explanation. It would have been better had an article been introduced, as in the case of trawlers and drifters, regulating as far as possible the shooting of the long lines, with a view to prevent the entanglement from taking place. Article 22 provides that "except in cases of salvage and the cases to which the two preceding articles relate, no fisherman shall under any pretext whatever cut, hook, or lift up nets, lines, or other gear not belonging to him." This is good as far as it goes, but the right to do this ought to extend to cases where such a proceeding becomes necessary for the purpose of identifying an offending vessel whose name or number for sundry reasons cannot be discovered.

Article 21, section 1, provides that: "All fishing boats, all their small boats, all rigging, gear, or other appurtenances of fishing boats, all nets, lines, buoys, or other fishing implements whatsoever, found or picked up at sea, whether marked or unmarked, shall, as soon as possible, be delivered to the competent authority of the first port to which the salving boat returns or puts in." Now Article 11 distinctly orders that all gear shall be marked; and the very fact of inserting the words "marked or unmarked," here seems to be an acknowledgment that the law will not be obeyed, and is calculated to lead some persons to consider whether they shall mark all their gear, as this might be the means of identifying them in case of their doing damage to another, or whether they shall not mark their gear, and run the risk of losing it entirely, through not being able to claim it if picked up, for the want of such marks. Section 5 of this article says: "Fishing implements of any kind found unmarked shall be 'treated as wreck.'" This should have been, *shall be liable to forfeiture*, so that unless a person could satisfy the authorities why his gear was not properly marked, he should lose it, whether salved or in use.

In this section it will be noticed that the term used is "found unmarked," not as in the first section, "found or picked up at sea," so that it may be inferred that if the captain of a cruiser finds nets in use not marked, they are to be treated by him as wreck. If the idea were different, the word *salved* should have been used instead of "*found*."

Section 3 of this same article reads as follows: "The administrative or judicial authorities, according as the laws of the different countries may provide, shall fix the amount which the owners shall pay to the salvors." For the sake of preventing international disagreements it is to be hoped that *our* Government, at least, will take steps to insure that the authorities here named shall be well acquainted with the value of both English and foreign fishing gear. At present it would be very difficult to find one of these said authorities who possesses such knowledge; many do not know the value of English gear in its new state, much less when it is damaged, as salved gear generally is to a greater or lesser extent. Difficulties have already arisen in the case of English nets salved and taken into foreign ports; the salvage claimed is frequently nearly the full value of the gear, thus prohibiting the owner from reaping any benefit from its having been picked up.

The latter portion of the 4th section in this article tends to confirm the above. It says that "the high contracting parties reserve the right of regulating by special arrangements between themselves the amount of salvage at a fixed rate per net salved." This fixed rate per net from a practical point of view is an absurdity; for when drift-nets are salved, it is usually bad weather, and some nets may be whole, others more or less torn or destroyed. Then comes the question, what is a net, and where is the line to be drawn? In some cases only the net-rope and corks will be left, and it would not do for an owner to have to pay for this as a net. If as a net, it will not answer the owner's purpose; if not as a net it will not answer the salvor's purpose. The nets may be new or old, and it would not be fair to award the same salvage for a net worth sixty shillings as a net worth five shillings. The rate of salvage, if fixed at all at a stated rate, would have to be low to suit the case of old and damaged nets, and if new nets were salved it would not induce salvors to deliver them up, knowing that they would only receive salvage on the value of old nets.

Article 30 provides that "Commanders of cruisers shall verify the damage from whatever cause arising." This should be "*shall verify that damage has been done, the nature of same, estimated probable amount, and from what cause it* *is alleged to have arisen, and give the master of the vessel whose gear has been damaged a certificate to that effect, which shall be presented to the proper official at the port to which the vessel belongs immediately on arrival, that he may have the opportunity of inspecting the damage done, and certify accordingly.*"

From a practical point of view it would be impossible for any commander of cruiser or even practical man to judge at sea what damage had been done to nets. It can only be ascertained properly when the boat arrives in harbour and gets out her gear. Then a proper examination and estimate of damage to gear can be ascertained.

Article 37 provides that "the proceedings and trial in cases of infraction of the provisions of the present convention shall take place as summarily as the laws and regulations in force will permit." So far so good, but it should also provide that acknowledged debts under this convention should be also recoverable in a summary manner in all ports, as a first charge on the vessel having committed the damage, and on her stores and gear. This would distinctly show that the owner is responsible, not the master. As the convention now stands it does not point out the party to be sued in international disputes. It simply states that the offenders shall be tried, and in cases where pecuniary recompense is required, it would not often be of any use to sue the master, or even the owner of a mortgaged vessel and possibly hired gear. Or suppose damage has been done by one fisherman to another, and they have agreed on the amount to be paid in the presence of the commander of a cruiser, the debtor would not come under Article 37, because it would not be a "case of infraction of the provisions of the present convention," but a compliance with them under Article 33, which states that "When the act alleged is not of a serious character, but has nevertheless caused damage to any fisherman, the commanders of cruisers shall be at liberty, should the parties concerned agree to it, to arbitrate between them and fix the compensation to be paid. Where one of the parties is not in a position to settle the matter at once, the commanders shall cause the parties concerned to sign in duplicate a formal document specifying the compensation to be paid. One copy of this document shall remain on board the cruiser, and the other shall be handed to the master of the boat to which the compensation is due, in order that he may, if necessary, be able to make use of it before the courts of the county to which the debtor belongs." This word "debtor" here leaves the question open as to who is to be considered the debtor in international cases, whether it is the master who has signed the agreement as to damage to be paid for, or the owner, mortgagee or vessel. The remarks made on this convention are sufficient to show many weak points which it would be better to amend before the convention is ratified. It is evident that when this was being framed there was not a sub-committee of practical men, comprising representatives of the various nations interested, to advise the plenipotentiaries, who cannot be expected to be practical fishermen, on the practical points. If this had been the case the convention would have been the same in spirit, but of much more practical value, and much more creditable to our Government as the leading maritime power. If ratified in its present form it is calculated to lead to international disputes which are not desirable after such an amount of time has been expended with a view to avoid them.

Draft clauses

The next point for consideration is the draft of clauses relating to fishing vessels and their crews proposed to be inserted in the Merchant Shipping Bill, 1882. This emanated from the Board of Trade in July, 1882, and when it has been discussed, will show what an immense amount of ignorance still pervades the official mind regarding the fisheries. These clauses appear to relate to the three following distinct matters, viz.:—

Firstly. The granting of certificates of competency to the masters and mates of fishing vessels.

Secondly. The classing of fishing vessels as foreign-going ships within the meaning of certain sections of the Merchant Shipping Act, 1854.

Thirdly. The enactment of regulations in respect of apprentices and boys under 18 years of age engaged in the sea fishing service.

Clause C., relating to certificates for masters and mates, comes first for discussion.

It is difficult to distinguish particular classes of fishing vessels except so far as they may be engaged in a particular kind of fishing. A master who is competent to navigate one class of fishing vessel is competent to navigate any other class of fishing vessel, as far as surface navigation is concerned. Drift-vessels often engage in trawling or lining, and tralwers engage in lining, the same master in most cases continuing in command. Peculiar knowledge may be required by the master of a vessel fishing for a particular kind of fish; that is to say, the master of a herring drift-boat should know the habits of and grounds where to fish for the herring under various circumstances. The master of a trawler should know the same as regards trawl fish, and of a liner as regards line fish. But the examination under the Merchant Shipping Act, 1854, applies to the knowledge of surface navigation only, and not to the special knowledge required by fishermen. It would therefore be useless to grant a certificate of this sort in respect of any class of fishing vessels, but if granted at all should apply to all classes of fishing vessels. The intention of the framers of this clause is good, but as to the way in which it should be carried out, they show a great want of knowledge of the requirements of the fisheries, or the way to make this proposal beneficial. To be beneficial the examination for certificates should include practical fishing and the duties connected with it. But in this a distinction of certificates would have to be made in the knowledge of grounds, for a fisherman brought up in a Ramsgate trawler would not be acquainted to any extent with the grounds worked by the Hull trawlers, and *vice versa*, and the same may be said generally regarding the various fishermen and fisheries. It must be borne in mind that hitherto the Board of Trade have only dealt with surface navigation; as soon as they begin to deal with fishermen, quite a new school is opened, in the form of bottom navigation among the various rocks, shoals, pits and holes of the sea, and the various mixtures and colours of the sand, shingle and mud met with. Certificates will be of very little use as a stimulus to the fisheries unless these various subjects are added.

Clause D.—Masters and mates certified under the Merchant Shipping Act, 1854, are liable to Board of Trade enquiries, and to suspension of their certificates, in the event of incompetence being proved. Masters and mates becoming certified under this draft Bill would therefore become liable to certain penalties to which they have not hitherto been subject, and for which there is really no necessity. For the insurance clubs in which the fishing vessels are insured partially carry out these penalties at present, and exercise such a careful and active supervision over the masters, that if a master commits any act of negligence or carelessness, or misconducts himself, and the owner of the vessel does not discharge him, the club or clubs in which such vessel is insured will refuse to insure her, or any other vessel in which the offender may be employed as master. This course has the effect of making masters very careful both in their conduct and in matters of fishing and seamanship. Therefore the portion of the clause which would impose Board of Trade enquiries is not required, unless it were to empower at each port a committee composed of practical men, elected by the various insurance societies, to try cases of casualties and suspend certificates. Each club or society should be allowed to have one representative on the board for every fifty members which it represents. This would only be legalising what is now virtually the system pursued in cases of casualties.

Clause E.—Many of the masters and mates of fishing vessels are illiterate, and although quite able to handle and navigate a fishing vessel, and to feel their way with the lead, which is the fisherman's practice, would be found quite unable to pass an examination, unless such examination were *viva voce*, or took the form of a practical exhibition of their knowledge of navigating a fishing vessel at sea. As it appears desirable that masters and mates of fishing vessels should have legalised certificates, the period for making a written examination compulsory should be extended to seven years. That would give an opportunity to any who are now boys, and unable to write, to get a certificate, and those now entering the calling would know what was before them. During these seven years, after first having given certificates of servitude to all present masters and mates, holders of servitude certificates should be allowed to undergo voluntarily an examination for a certificate of competency, in writing if they should so wish, and the certificate should certify in which manner the holder passed. The fishing grounds should be, for examination purposes, divided into districts, and a man could then pass for navigation generally and for a knowledge of one particular kind of fishing, or of all of them, or of one particular district or of several. If this is done certificates will be of value to the industry, and if any of these suggestions are lacking, so will a certain amount of the utility of the certificates also be lacking. Each year of the seven years the standard might be raised a little, so that the innovation should come gradually. The fees for examination should also be fixed at as low a rate as possible.

Clause F.—This definition of coast vessels is very unsatisfactory, for all round the coasts may be found undecked, quarter-decked, and half-decked boats, which would under this clause become sea-going vessels, which would be an absurdity, and would from all appearances frustrate the intentions of the framers of the Act, showing the ignorance prevailing on these matters in official quarters. In some cases open boats of about three tons would become sea-going vessels.

Clause G.—A voyage of a vessel engaged in the trawl fishing averages six weeks, being at some ports a month, at others six weeks or two months. The vessel would be fitted out with stores and provisions for the full extent of this time if going to the fleet. If single boating possibly a few articles would be got fresh from time to time. With lines for live fish, a voyage generally means the time they are getting the well full, and is very indefinite, but sometimes the crews ship for a period, which in this case would be the voyage. With drifters universally the voyage means to commence at a certain time, and keep at it, as long as the fish remain on the grounds, say from one to three months, so that, in fishing parlance, what is here termed a voyage is only one trip of the voyage. A drifter may leave and return to port perhaps four or five times a week under favourable circumstances if the fish lie close in. If this were to become law in connection with the next clause, these vessels would have to clear in and out at the custom house every time, and at some ports at certain times fifty clerks, working night and day, would not be sufficient. Vessels frequently arrive in port at night after the custom house is closed, discharge their fish and go to sea again in the morning before it is opened.

Clause H.—There are serious objections to fishing vessels of any description being classed as foreign-going ships within the sections of the Merchant Shipping Act, 1854 referred to in this clause. If this were to become law, the effect would be that fishing vessels within the clause could not proceed to sea unless the master and mate had certificates of competency. This would sometimes act very hardly on fishing vessels, for if the master or mate were taken ill the vessel would probably be detained; whereas it now happens that when the master is taken ill, the mate usually takes charge, and the next in acting to the mate takes his place for the time being. If this proposed law permitted the next in grade to take the master's and mate's places respectively in cases of emergency for that voyage only, irrespective of certificates, no injury would be done, but if this is not done it will often inflict an injury both on the owner and the rest of the crew. It would also be better from a practical point of view, because these men would be accustomed to the working of the vessel and her gear, and would really be more competent to complete the voyage than an entire stranger. Certificated men would not be likely to be standing about waiting to be shipped, as inferior hands do, and the time consumed in looking or waiting for a certificated master would often cause a vessel and her crew to lose at least one night's fishing, which would mean sometimes from £100 to £200.

Section 145 of the Merchant Shipping Act, here incorporated, provides that apprentices and boys under eighteen, and their indentures or agreements, should be brought before the shipping master before each voyage, and taking this in conjunction with Clause G. of these clauses, this would be necessary in many cases every other day or so; as, whenever the vessel returned to port, the apprentices and boys with their indentures and agreements would have to attend before the shipping master. As fishing vessels frequently proceed to sea immediately they have delivered their catch of fish, the delay caused by this would be unendurable. Sections 150 to 154 provide for running agreements, the need of which is not known under the present system, as crews ship for the voyage and there the matter ends; no alteration in this respect is required, nor would it benefit anybody.

Section 157 imposes a penalty of £5 for shipping seamen without an agreement duly executed, but in practice, in case of a hand being shipped on an emergency, there is frequently no time, if the vessel is to save the tide and her night's fishing, to enter into any written agreement, for the sailing of a fishing vessel is not of so momentous a nature as that of a large foreign-going ship; and it frequently happens, especially since the passing of the Act of 1880, that a casual hand has to be shipped at a few moments' notice. In fact, in large drift-fishing ports there is always a class of men standing about the quays looking out for these casual jobs, their sea-boots on and oily frocks under their arms, ready to jump on board at once. Further, section 158 provides for changes in the crew to be reported, under a penalty of £5, which, if enacted, would cause a further loss of time to the owners and to the vessel, which means a pecuniary loss to both owners and crews, and a loss of means of subsistence to the nation.

Section 161 lays down rules as to production of agreements and certificates of masters and mates to the shipping master, and would necessitate a clearance inwards and outwards each trip, and thus redouble the delay and loss of time proposed to be accomplished by the preceding sections. As despatch is the soul of the fishing industry the loss which these sections would cause would be incalculable.

Section 170.—This section provides for the discharge of seamen and payment of their wages before the shipping master, under a penalty of £10, and so far as the drift fishermen are concerned is positively impracticable, inasmuch as two or three days before Christmas at one port alone about 200 boats, each with a crew of from nine to twelve hands, are paid off daily, each man receiving his share of the net proceeds of the voyage according to his rating. Deductions from the gross earnings on account of provisions and damages have therefore to be made, and accounts and vouchers produced. Each of these men will also be probably found to have had advances made to him on account of his share, and to have been supplied with tobacco, clothes, or other necessaries, the value of which also has to be deducted. At Great Yarmouth a sum of upwards of £100,000 is annually distributed among owners, crews, and tradesmen during the fortnight preceding

Christmas. Were each of these settlements to take place before the shipping master, it would take two or three months to discharge the crews, who are mainly composed in this, as in other cases of men residing within a radius of twenty miles of the port, and who at the end of their voyage are anxious to receive their money and to return home. This proposal is therefore perfectly impracticable, not only at this, but at all ports, as the rule is similar in a greater or lesser degree. Besides all this another difficulty would arise in the following manner. The wages of trawl and line fishermen, when they are not wholly or partially by the share, are either wholly or partially drawn weekly by the person nominated by the men; for this purpose a card is given in most cases to the fisherman when he ships, and on this card being presented weekly to the owner the money paid is entered on it. Where this money, in the case of a man on weekly wages only, is fully drawn every week, a fisherman at the end of his voyage has frequently nothing to receive, unless it be a portion of a week. In the case of drifters and vessels by the share, when a man has money due to him he generally draws some for the maintenance of his family or for his own use. If this proposed clause were to become law, the regular payment of wages to the families of fishermen would be illegal, and such families would, in the absence of the breadwinner, be left to starve or go to the workhouse.

Section 269 appears to be the only one of all the clauses which is acceptable to the fishing community without considerable alteration. This provides that enquiries should be made into the cause of death on board foreign-going ships by the shipping master on the arrival of the ship in port, and would very properly apply to fishing vessels in cases of death on board or drowning.

Section 4 of the Merchant Seamen Payment of Wages and Rating Act, 1880, also here incorporated, by subsections, provides as follows: Subsection 1. "That the balance of wages due to a seaman shall be paid him within two days after he leaves his ship." This, in the case of fishermen fishing by the share, or of masters or mates of smacks receiving poundage, would be impracticable, as in the case of fish being sent away for sale at an inland market, which is frequently done, the account sales and cash not being received from the consignee (weekly settlements being the custom), the balance of such wages would not be in hand or known, and could not therefore be paid; while in the case of drift fishermen the many disbursements for the voyage might not be known, or the accounts made up, and therefore the balance due could not always be ascertained. This subsection, by mentioning the word "balance," evidently anticipates that advances will have been made. It therefore qualifies section 170 of the Merchant Shipping Act, which is previously incorporated, and which reads in the portions bearing on this point: "Shall be discharged and receive their wages in the presence of a shipping master," and any owner who "pays his wages within the United Kingdom in any other manner shall incur a penalty not exceeding ten pounds." Evidently, then, paying a fisherman on account weekly or otherwise would be illegal under this clause.

Subsection 2, coupled with section 171, of the Act of 1854, provides for the making out by the master of an account of wages and of all deductions therefrom, being set out under a penalty not exceeding £5, and no deduction is to be allowed unless included in the account so delivered, the master to enter the various deductions as they occur in books kept for that purpose. Now, as many masters are illiterate, it would be impossible for them to make the entries required, and therefore, until the period of seven years is passed, all entries required to be made by the master should be legal if done by some one else at his dictation; or in the case of a master not being able to read, he should be compelled to verify such entries before a proper officer at stated periods, after the same had been read to him; or perhaps, if only one man on board could write, as is sometimes the case (and sometimes none), and he were ordered to enter a fine or deduction against himself, he might enter it to some one else, or make a different entry altogether. Further, to enact that no deduction be made unless it be included in the account delivered to the seamen, would create hardship, as an error therein could not then be rectified, and it should be borne in mind that fishermen sailing by the share are, with the masters and owners, somewhat in the nature of partners, and errors in their accounts, as in other partnerships, ought to be open to rectification. It will not be out of place here to suggest that all fishing vessels should keep a simple log, of an approved form, to embrace loss of life, casualties, misconduct of crew, fines, and cash advances, subject, as regards its being compulsory, to the before-mentioned term of seven years, after which it might beneficially be made compulsory.

Subsection 3 provides for the final settlement of the seaman's wages being left, with his consent, to the Superintendent of the Mercantile Marine Office, and the receipt of the superintendent to operate as a release under section 175 of the Merchant Shipping Act, 1854; but it not having been proposed that fishing vessels should be foreign-going ships under section 175 of the Merchant Shipping Act, 1854, it does not appear that the owner would be entitled to the benefit of the statutory release by the seamen under that section.

Subsection 4.—Having regard as to what has been stated in respect to subsection 1, this subsection must be very carefully applied.

Subsection 5 provides that all questions of wages raised before the superintendent between owners and seamen shall, if the amount does not exceed £5, be adjudicated upon by such superintendent, whose decision shall be final. It is not desirable that summary jurisdiction, in which questions of fact and law are contained, should be left to be determined by a superintendent of fisheries or marine without any possibility of appeal from their decision. These questions of law, therefore, should be left to the decision of the magistrates, who are assisted by their clerk.

I.—This clause meets a want which has not yet been discovered in the fishing industry.

K.—The question again arises as to what is meant by a particular class or classes of fishing vessels; for, as has been before stated, a person competent to (surface) navigate one fishing vessel as master is competent to (surface) navigate any other fishing vessel; and if he has the requisite knowledge of the fishing grounds, the mode of fishing, and the habits of the fish, which he would obtain when serving in a subordinate capacity to that of master, there seems to be no reason why he should not be qualified to act as master of any fishing vessel whatsoever. Just for a moment to call attention to the difference in the various classes of fishing, it may be stated that a boy who had served his apprenticeship on board a liner would be of very little use to a trawler or drifter, and *vice versa*. There would be no more justification in treating the various classes of fishing as all one than there would be in classing a saddler as a shoemaker. These both work in leather, but their industries are vastly different and quite distinct.

L.—This and the following clauses to O. inclusive, apply not only to apprentices so-called, but to all boys under eighteen years of age engaged in fishing, whether apprenticed or not, although the term of their engagment may be for one day only. If the provisions of this and the three following clauses be enacted, it will become impracticable to ship boys at all when under the prescribed age, and this would be a very serious obstacle to the development of the fisheries, especially at some drift ports, where frequently half the crew are lads under eighteen years of age. Now clause 132 of the Merchant Shipping Act, 1854, provides for the apprenticing of boys at the age of twelve years to the sea service, which proves that eighteen years of age is by no means too early a period for a lad to go to sea, and were the practical result of these clauses to prevent boys from going to sea until they had obtained eighteen years, they would meanwhile fall into some other occupation and lose their taste for the calling of a fisherman. This would be most prejudicial not only to owners and fishermen, but to the interests of the country at large, as it is no doubt a fact that boys who first go to sea as fishers eventually supply a great portion of the seamen with which our Royal and Merchant Navy is manned.

Even if indentures of apprenticeship be made subject to the stringent regulations comprised in Clauses L. to O., there is no reason why a mere agreement with a boy under eighteen years of age should be so regulated. Apprentices to the drift-fishing are unknown, and at some large ports apprentices to the trawling are quite the exception, and the boys ship for the voyage only. Therefore great injustice and inconvenience would be entailed by the enactment of Clause O., which provides that "every such indenture of apprenticeship and agreement as therein mentioned shall contain all the covenants, provisions, stipulations and certificates set forth in the form of apprenticeship indenture, in the schedule to the draft clauses, and that indentures and agreements not in accordance therewith shall be void against the apprentice or boy." At no port is it the custom to provide meat, drink, lodging, washing, sea bedding, and wearing apparel, for the boys engaged not being apprentices. They are provided with board while afloat, but provide their own sea bedding, wearing apparel, and other necessaries. On shore they provide their own board and lodging, generally living with their parents or relations; and no master, as is proposed to be required, would undertake to be saddled with the responsibility of looking after boys (not apprenticed), while they are on shore, and most likely under the control of their parents or relations. If these clauses are to apply to all boys under eighteen years of age, even if not apprenticed, the employment of such boys in the fishing industry will at once be abolished by an impractical law, and consequently serious injury to the fisheries and the nation will arise.

Sufficient reasons have now been given to indicate that, with the solitary exception of Clause 269 of the Merchant Shipping Act, 1854, as regards fishing vessels, the draft clauses, as they are drawn up, are positively detrimental to the fishing industry, as well as impracticable. One main objection is, that the regulations proposed by these clauses would cause great delay, while expedition is the very life of this industry.

Fish are here to-day and gone to-morrow, and must be caught when the opportunity offers, therefore every facility ought to be given for the vessels to go out and return, and their owners and crews to receive their money without let or hindrance, subject simply to a right of appeal in cases of dispute. Whatever their aim may have been, the framers of these draft clauses drew them up without any (or indeed very little) practical knowledge of the details of the fishing industry, which must be thoroughly understood before any regulations can be applied thereto, having for their object the promotion of its prosperity. The provisions the Merchant Shipping Act proposed to be incorporated, were drawn up under the advice of practical cargo-ship sailors, with the intention that they should be applied to sea-going cargo-ships, which proceed on voyages of considerable duration from the time of their leaving and returning to their port, and are commanded and manned by a very different class of persons. Local coasting vessels and vessels in the home trade are exempt from the restrictions and hindrances proposed to be imposed by the draft clauses, how much more therefore ought fishing vessels to be exempt?

Apprentices' indentures.

It will now be well just to consider the forms of indenture for apprentices.

In May 1855, the Board of Trade sanctioned a form of Ordinary Apprentices Indenture marked I.; this has been in general use at most ports up to the present time, and has answered very well, and by slight alteration will suit for either an indoor or an outdoor apprentice. A change being deemed necessary, the Board of Trade in May 1880 sanctioned a fresh form of indenture, which is generally known as the Grimsby indenture.

In Clause 1, an improvement is introduced which compels the apprentice's master to be the holder of not less than one-eighth share of a fishing vessel; this is done to check the practice among a certain class who are not owners, of taking apprentices and letting them out to actual owners in order to make a profit out of them.

Clause 2 is the same as in the old indenture, with the exception of the words "nor play at unlawful games."

Clause 3 is similar to the old indenture, but in addition compels the apprentice's master to find sea-bedding, wearing apparel, and necessaries, and makes provision that the master shall state the amount of the spending-money to be allowed to the apprentice. The idea evidently is that the outdoor-apprentice system shall be abolished, which is very desirable, and that, where the master cannot keep the apprentice in his own house, when ashore, he shall provide proper accommodation for him at a licensed lodging-house, and thus endeavour to keep the apprentice out of harm's way. This is a great improvement on the old system of outdoor apprenticeship.

Clause 4 causes the clothes of the apprentice to remain the property of the owner during the term of apprenticeship. This is a step in the right direction.

Clause 5 binds the master to provide board and lodging to the satisfaction of the superintendent of mercantile marine. This is unnecessary, if it is stipulated that apprentices shall be lodged either at the master's house or at a licensed lodging-house.

Clause 6 provides that the spending-money shall be paid to the apprentice himself, unless through misconduct the superintendent orders otherwise. But that all remuneration, payments, and salvage to which the apprentice may become entitled, shall be paid by the master to the superintendent to be put into a Savings' Bank, till the term of the apprenticeship is determined, whether he likes it or not. Now, boys (this indenture applies to boys not apprenticed) and apprentices frequently aid in supporting their parents, and their earnings, including any salvage earned, are generally paid to their mothers or nearest relations, which could not be done were the draft clauses, and this indenture combined, to become law as proposed, and would cause great hardship. Moreover it is not clear how long the superintendent would hold the money of a boy not apprenticed. It is true that by Order in Council, as proposed in clause 6, of the draft clauses, this would only apply to certain ports as ordered, but when once in force at any port no boy not apprenticed could go to sea without entering into this agreement.

Clause 7 simply confirms the addition alluded to, as made in Clause 1 of the indenture.

Clause 8 compels the master to attend with the apprentice at least every half year before the superintendent. It would be difficult to find masters to undertake to attend once in every half year during the continuance of the apprenticeship before the superintendent, as here required. Exception would have to be made in cases where the master sailed in one vessel, and the apprentice in another, as is sometimes the case, the two never being ashore at the same time. This should be struck out, and the apprentice given fully to understand that if all did not go on to his satisfaction, he should appeal to the superintendent for his interference, if necessary.

Clause 9 fixes the period of probation at six months, and then, if the superintendent thinks proper, he can refuse to endorse or confirm the apprenticeship, which then becomes void. This period of six months is too long; owners would be troubled with a lot of boys (who would make a regular affair of it) whom they would have to keep and clothe for six months at a loss, as they would be of very little use, and just as they were getting useful, the boys could, if they wished, withdraw on some plea, and get a berth elsewhere at weekly wages, having got an insight into the business at the expense of somebody else. The period of probation named is too long, and would tend to check the apprenticeship system very much.

Clause 10 gives power to the superintendent to cancel the indenture at any time during the probationary period. This power should not be given to the superintendent, and is objectionable.

Clause 11 bears on the above point, and is objectionable so far as the superintendent is concerned, for it does not appear right that the jurisdiction of the magistrates or any other court, in respect to disputes between master and apprentice, should be ousted by reference to a superintendent of shipping, who, although possibly a very worthy person, is not likely to be able to decide these matters of law as the magistrates are, who are assisted by their clerk.

Clauses 12 and 13 are binding clauses, and having regard to the class of persons who enter as apprentices or boys in the fishing industry, the bond or obligation here provided is an absurdity, and so is the whole indenture, when it is set forth to be used where boys who are not apprentices are concerned. It shows that the Board of Trade are competent to deal with this question in those parts where the shore life of the apprentices is concerned; but the other portions, which relate to the really practical parts, again show that the official mind is not so fully informed as it ought to be when legislating for the fishing trade.

Fishing Agreement.

Another document, sanctioned by the Board of Trade in March 1882, must be discussed, as it is an important point to the whole trade. The title of it is: "Running Agreement and Account of Voyages and Crew of a ship engaged in the Sea Fishing Trade only, with Official Log attached."

This agreement applies to trawlers, codders, drifters, and all classes of fishing vessels. The first thing which attracts attention is a notice which commences as follows: "The Board of Trade have dispensed with the attendance before the superintendent of a Mercantile Marine Office, of seamen engaged and discharged under this agreement." Here is another conspicuous blunder. The document from which the above extract of notice is taken, was sanctioned by the Board of Trade in March 1882, and clearly shows that a fisherman may be discharged anywhere. In July of the same year, only four months after, the same department prepared the draft clauses relating to fishing vessels and their crews, already discussed, and clause 11 incorporates section 170 of the Merchant Shipping Act 1854, which states that "all seamen discharged in the United Kingdom shall be discharged and receive their wages in the presence of a shipping master duly appointed under this Act," and finishes by causing any one who does otherwise to incur a penalty not exceeding ten pounds. Thus within a few months of making an order, this department frames a Bill incorporating a section of an Act of Parliament which distinctly negatives the order. This needs no comment, but is only another instance of the way in which the trade has been harassed of late years. After this notice follow particulars of ship and employment, apprentices on board, and crew. Then comes a scale of fines sanctioned by the Board of Trade for certain offences. No. 1 is for not being on board by the time fixed by the agreement, 5*s.*; so that, "if a man who has shipped to a vessel does not join, and causes the remainder of the crew and owner to lose perhaps £100, or more, he can condone the offence by paying the munificent sum of 5*s.* to the Mercantile Marine Fund. This agreement would prevent an owner from shipping another hand, and charging the cost to the offender, if he has anything due to him, as is sometimes the case. It would make men more independent of their agreement than ever to know that the full extent of their liability for causing a fishing vessel and crew to lose a night's work was only 5*s.* The same remarks apply to No. 2, for which the same amount of fine is inflicted, for "not returning on board at the expiration of leave." This is as bad as the ordering by the Act of 1880, that for these offences a man, who, as a rule, has no effects, should be sued for damages. By agreeing to these fines an owner legally contracts himself out of any benefit he might be able to derive from any legislation which does or may exist purposely to deal with "neglecting to join," &c., and even if a man had effects, the owner could not recover damages, as the agreement would be put forward that the offender was to be punished with a fine of 5*s.* All the other penalties are for minor offences, and may be passed over without comment, except Nos. 6 and 9. No. 6 orders a fine of 5*s.* "for sleeping or gross negligence while on the look-out." The other the same fine for "man on watch failing to exhibit lights at proper time." Let them be weighed. On the one side there is a careless or reckless man threatened with a five-shilling fine; on the other, the lives of from five to twelve men on one vessel only placed in jeopardy. Surely this is too great a difference to be tolerated! Then follow some instructions to masters, and after that comes a form of agreement. The first thing that attracts the eye is the old formal space left for pounds and ounces of provisions to be supplied every day in the week. As far as the fishing industry is concerned this is practically useless, as fishermen will never be satisfied with an allowance scale. They live as a rule considerably better than ship sailors. Next comes the agreement itself, which, if one-sided, will always be a source of trouble. In the first clause, the interests of the crew are entirely ignored in the sentence, "that the time for finishing the said expedition shall be solely at the discretion of the owner." It is neither justice nor equity for one man to have power to bind another man for, say three months, and then after the man so bound has made his arrangements accordingly, for the other, for some reason of his own, to break the agreement in a week, without even being liable to give any reason for so doing. A definite time should be stated, subject to alteration only by an equitable arrangement between all concerned. Clause 2 is the one under which the crew agree to do their duty, and keep the nets and outfit, except standing rigging, in repair, supplying all chafing gear where required. The meaning of these two sentences is a complete puzzle when looked at as applying to trawlers, codders, drifters, and all classes of fishing vessels. The framer of this agreement must have had a very poor idea of the important and varied interests he was dealing with. It might perhaps apply in the case of a few solitary trawling vessels, but in their case the rule would be for the owner to keep at least the sails and spars in repair (and these are undoubtedly included here, as the only exception made is standing rigging), and to supply all chafing gear required for the vessel. At some ports where owners find the trawl gear as well, they find the rubbers for the net, and all material, the crew simply finding the labour. In drifters sometimes the owner finds all gear, and takes the responsibility of all damage and losses. In other cases of drifters, the crew bear their share of losses at the rate of about twenty shillings for a lost net, and two shillings to three and sixpence for a spoilt one, but this varies much at different ports. At ports where crews share the losses a very perceptible difference may be noticed in the way the voyage is pursued. At the commencement when there is no money in hand for the owner to stop in case of lost gear, the boats as a rule shoot much more boldly than they will do at the end of the voyage when they have earned money, and know that, if they lose gear, they will have to bear a proportion of the loss. If they lose gear when they have no money in hand, the crews will often desert, and thus get clear of their liability, both as regards lost gear and money due to tradesmen for provisions, thus compelling the owner to bear all the loss, and possibly to lose the rest of the voyage for want of hands; whereas it might be made up if the crew were compelled to finish it according to their agreement. In liners the owner generally provides gear and takes all losses. Thus it will be seen that it is impossible for one form of agreement to meet all these varied cases, and further proof of this might be given.

In clause 3 the master agrees on behalf of, and with the consent of, the owner to pay the crew their wages or share, and to find provisions as per scale. At some ports the custom is for the owner to find all provisions, at others for the crew to find them, or for the provisions to be taken out of the gross earnings; this applies to all classes of vessels as well as ports. It is a matter of private contract, each owner working his vessel on the plan he prefers. Thus all that the owner is bound to do is to give the crew what they earn on board his vessel. There ought to be two sides to every agreement, and if the crew are to be bound to certain things, so in all fairness ought the owner to be on his part. The owner should state what his part of the contract is, to effect that he will keep the vessel staunch, tight, and erly found, and that he will provide a certain quantity shing gear of good quality, small boat, and any other ers necessary. Respectable owners would not object to and it would sometimes be the means of protecting crews shipping to a vessel belonging to a speculative owner, has perhaps purchased an old vessel cheap, and some gear, and intends to make it a case of sink or swim a financial point of view. If things go badly, and bad weather or other causes the gear is spoilt or lost, crew have to suffer through the bad speculation, in h they stood to suffer more loss but not to reap ter benefit than other boats.

clause 4 it is agreed that "any embezzlement or l or negligent destruction of any part of the ship's or stores, shall be made good to the owner out of vages of the person guilty of same." This is not right. embezzlement, &c., should not be made good to the ner" only; it should be *owner and crew* where the vessel on the share system, for in the majority of cases, and e share system the crew have an equal interest in the and fishing stores with the owner. This calls to mind estion which has been many times discussed, which w to put a stop to the system, very prevalent at some s, of the crew taking away large quantities of fish every they arrive in harbour, either on strings or in bags. ces have been issued by owners threatening prosecution ch cases, but without effect. It is not that a man is ged a few fish to take home to his family, but it is the e of it which ought to be checked. A man with a e and family will take home a fair quantity of fish; her of the crew (possibly one of the casuals before led to) who has no home, thinks, Well, I don't see why I should not have some as well as he, and consequently he takes some, and sells them for what he can get, generally much below value, to buyers, *alias* receivers, who frequent the markets for this purpose. This might be passed over, but it thus extends to getting as many as possible away in a clandestine manner in bags, oily frocks, and otherwise, for the purpose of sale. If some stipulation as to the quantity each man was entitled on a given catch, and no more, was inserted in the agreement, a man then found taking more than the quantity stipulated should be liable to be fined or prosecuted ; in case of a fine it should be payable as an addition to the gross earnings of the vessel. It is an acknowledged evil, or owners would not have combined to endeavour to stop it, though thus far without success.

Clause 5 alludes to the regulations for maintaining discipline, already referred to in dealing with the first page of this agreement.

Clause 6 states that the fish caught " should be sold," which is very absurd, as no fisherman was ever known to go to sea in order to give his fish away when caught. This is another specimen of the happy knack the Board of Trade has of making approximate laws or regulations open to question on all sides. If it is meant to be any use it should state whether, by auction, consignment, or private treaty, or by or to whom. This should at least be defined by the signatories for the sake of both owner and crew, as, if fish are disposed of privately by anybody on board, there is nothing in the agreement to stop it, and it would not be illegal in most cases, the men standing in the light of partners. Sometimes vessels run to strange ports and sell their fish, sometimes they sell it at sea, as drivers do to codders for bait. If a formal agreement is to be made, as appears to be the desire of the Board of Trade, let it be done properly, or else let the present system of verbal agreements continue.

Clause 7 refers to salvage.

Clause 8 fixes the time allowed for settlement at the end of the voyage, but it does not state by whom. Is the salesman, who has sold the fish, or the owner responsible? Suppose at the end of a three months' voyage the salesman fails, and the owner loses his share, are the shares or partnership accounts of the remainder of the crew to be deemed "wages," and taken from the first charge on the vessel and gear belonging to the owner, who has already lost his share? Surely not. But if formal agreements are to be made compulsory, these difficulties must be faced and cleared up. A legal definition of this wages, share and part-share system is desirable, for it is an exceptional system. It is not piecework, nor partnership proper, but payment by very uncertain results.

Clause 9 is left for deductions agreed on to be inserted.

Clause 10 is a space for any stipulations to be inserted to which the parties agree, which are not contrary to law. These would be very considerable, if stipulations were inserted to amend the previous part of this agreement, and an extra sheet of paper would be necessary.

Clause 11 provides that "if any member of the crew considers himself aggrieved by any breach of the agreement, or otherwise, he shall represent the same to the master or officer in charge of the ship in a quiet, orderly manner, who shall thereupon take such steps as the case may require." But suppose he does not "take such steps," or the grievance is not set right, what further remedy or appeal is provided for the aggrieved? None at all. The course for the aggrieved is then to desert, or rather to "refuse to obey lawful commands," and get taken before the magistrates, and then state his grievance as the reason for his disobedience.

Clause 12 gives an aggrieved member of the crew, in case of dissatisfaction with his account and settlement, leave to appeal to the superintendent, from whose decision there is no appeal. This power of a superintendent to decide cases of common law without appeal has been previously objected to.

Clause 13 is as follows: "that any member of the crew shall be liable to dismissal upon (   ) hours' notice, given to him by the said master or owner, and upon being paid the amount, if any, to which he is entitled in respect of his wages or share to the date of dismissal; and further that any member of the crew may claim his discharge at the time of any of the settlements above referred to upon giving a similar previous notice to the master or owner." This is a most curious clause, for in the first portion it gives an owner or master power to break the agreement and discharge any one of the crew at any time, subject to a certain number of hours' notice, and upon paying the amount due for wages or share to date of dismissal, so that the (   ) hours' notice without the money to date is not a legal dismissal, and what would be the use of the (   ) hours' notice, when a man had received all his money? Practically it resolves itself into the fact that an owner can discharge a man at any time by giving him his money to date. To be properly defined and practical, it should have been worded to the effect that the owner or master should give the (   ) hours' notice, and pay the man the full amount of money due to him at the expiration of such notice. If this be the correct construction as intended by the framers, the wording is very careless, and ought not to be possible, emanating as it does from a Government Department. Under the second portion, no member of the crew can claim his discharge except by giving (   ) hours' notice to the master or owner previous to the time of settlement. This, in the generality of cases, means the end of the expedition or voyage, when the agreement would be terminated, and the crew their own masters, without needing any (   ) hours' notice to be given. Moreover the agreement itself proves that only one final settlement is expected, as, in the space for wages, a column is reserved which is headed "Amount of weekly allotment," and space is provided for only one settling up. To sum up, clause 13 gives an owner or master power at any time to break the contract and discharge any member of the crew, and purports in the latter part to give the crew a like privilege, but practically does not do so. Thus an owner under clause 1 and clause 13 can terminate a voyage and break the agreement at any time, and the crew have no redress. This is neither just nor equitable.

Page 3 of the agreement is too cramped to be practically properly kept.

Page 4 is devoted to space for particulars of certificates and their endorsements.

Page 5 is space for report of character, the utility of which it is very difficult to see, as it would simply, under the present arrangements, be taken to the office of the Superintendent of Mercantile Marine, and there would be an end of it. It would not affect the fisherman, and it would be impossible for a Superintendent of Marine to keep a register of the characters of fishermen, for many make a practice of changing their names.

Page 6 gives instructions as to what entries are required to be made in the log under section 282 of the Act of 1854. Under this there is a note by which the Board of

Log book.

Trade directs that, in case of deaths occurring on board, "On arrival at the port of destination in the United Kingdom the official log book must be deposited with the Superintendent of Mercantile Marine, to be forwarded in due course to the Registrar General of Seamen." In the first place the Act of 1854 was not framed to meet the cases of "lost overboard," or "drowned from capsizing of boat," so common amongst fishermen; it was evidently framed to meet the more frequent occurrence on board foreign-going ships of death from diseases such as scurvy, smallpox, fevers, &c. Cases of drowning being the exception in this class of ships. To meet the case of fishermen this Act should be amended on this point, for at present, strictly speaking, the law does not order the entry in the log book of the death of a man which does not occur on board, as in the case of a man being drowned, or capsized from a small boat. In the second place, if the log book retains its present form (and this applies in case of the drowning of a man) the log book and agreement would have to be given up on the next arrival of the vessel in port, though her voyage was not finished. This again was intended to apply to foreign-going ships, which, when they arrive in port, have terminated their voyage, and done with their crews; whereas a fishing vessel, as before explained, makes a number of trips to port before her voyage is completed. It is useless on the part of the Board of Trade officials to keep attempting to incorporate all these clauses of the Act of 1854 (which were not intended to apply to fishing vessels, but principally to large ships), with new legislation, especially adapted to fishing vessels. It proves either incapacity or carelessness. If the former, it is high time that practical men should be selected to advise on the question; if the latter, then the sooner the fishery legislation is removed from this department, the better for the nation at large. The words "on arrival at port of destination" should (to apply in the same manner to fishing vessels) be altered to the words, "at the termination of the voyage," and a preliminary report be made at next port of arrival after any case of loss of life, otherwise both the agreement with the crew and the log book would have to be renewed in cases of loss of life, which would cause unnecessary delay.

Subsection 6 of the 282nd section of the Act of 1854, here incorporated, is worth remarking as a peculiar one. The marginal heading is "quitting ship." It orders the entry in the log book of "the name of every seaman or apprentice who ceases to be a member of the crew otherwise than by death, with the place, time, manner and cause thereof." This evidently means a "desertion," but called by two other names, viz. "quitting ship" and "ceasing to be a member of the crew." This causes the question to arise, What is a desertion? It may be construed out of any of the following terms which are used in the Act of 1854: Neglecting to join, absence without leave, quitting ship, neglecting to join after leave of absence is expired. How is a master or owner to decide between them? A man may belong to a drifter, and neglect from some cause or other to be on board his vessel at the proper time, but has no intention of remaining away altogether. The master or owner not knowing that the absence is enforced or unintentional deals with it as a desertion. When the vessel comes in again (next day perhaps), he presents himself; he is then told he is not wanted, and his clothes and wages are forfeited. The man has no remedy, and this appears to be harsh treatment, but it would be legal. The 243rd section enacts that the effects and clothes of a deserter, and all wages or emoluments due to him, shall be forfeited, but it does not clearly state to whom they shall be forfeited; but in the case of voyages by the share, it is presumed that the proceeds of such effects, after being sold by auction, should be added to the gross earnings of the voyage, as the crew have to put up with the inconvenience or loss arising from the desertion, as well as the owner. They are not like monthly seamen in cargo ships.

Attention is called at the foot of page 3 of the official log book to the fact that the sale of effects of every seaman who has died must be entered and witnessed in the log book. In the case of fishing boats, it does not appear desirable that the effects of a deceased member of the crew should be liable to be sold, as the vessel will probably arrive in port next day, and they might then be handed over to a proper authority on behalf of the relatives of the deceased. This is another instance of the absurdity of trying to adapt to fishing vessels the Merchant Shipping Act of 1854, which was principally framed to apply to cargo ships.

This finishes the discussion of this document, which though good in intention, miserably fails in carrying out that intention practically. The great difference in the various classes of fishing, which has been abundantly shown, appears to demand a series of agreement forms adapted to the various classes and modes of carrying on the fishing industry. To draft these would require from practical men all the care possible, and unpractical officials as far as the fisheries are concerned, could never draft them satisfactorily without such assistance.

Steam boilers. The next point for discussion is the use of steam on board fishing vessels for capstans and pumps only. The Merchant Shipping Act 1854, nowhere provides legislation for any vessels which use steam, except those *propelled* by steam, this being a modern innovation. As this innovation is yearly increasing, it is desirable that the law should be made clear as to the measuring for registration, whether any allowance is to be made for engine-room or not, and what penalties are applicable for weighting safety valves or other offences, as fishermen are sometimes in a hurry to get in their gear. What course of procedure should take place in cases of boiler explosions, or whether section 326 of the Act of 1854 shall be altered to meet the case, should also be clearly laid down.

Employers' liability.

The next point is whether the Employers Liability Act, 1880, extends to fishing vessels and their crews, and if so, whether a man sailing by the share would be entitled to recover; does he stand in the position of a workman, or is he a partner, and consequently not entitled to damages? Again, in the event of this being overruled, how could the damages be assessed in this uncertain calling? Or how would a man stand in law who was partly wageman, partly shareman? At Sunderland three caulkers working on board a vessel recovered £880 damages and costs for injuries received. At the same place three shipwrights recovered £185 and costs. Now it is possible that these men might have been working on board a fishing vessel doing some temporary repairs, as is often the case, and a falling spar or something else might have injured them, and also some of the crew who were weekly men. Would the law rule that one man could recover and the others could not? both very likely being under the same employer. It does not appear probable.

Fishery Board, Scotland.

The Herring Fishery Board was established in the year 1808 by Act of Parliament, and the object and summary of the provisions of the Act as given in 48 Geo. III. c. 110, are as follows: "That whereas the improvements of the British

White Herring Fisheries is an object of the most essenti importance to the wealth and commercial prosperity, a well as to the naval strength of this kingdom, for th attainment of which it is expedient that more effectu regulations should be made in order to the insuring a d and proper attention to the curing, sorting and packing white herrings, that the credit of the British Fisheries i our Colonies and foreign parts may be maintained, be therefore enacted," &c. The principal duties of the Bo have been to collect statistics in connection with the herri fishery, to brand cured herrings according to quality, and c lect the fees for so doing, to gauge the barrels, and inspe the same during the manufacture, so that they may all of one standard size. There are other minor duti which can all be more efficiently performed, and with ver little extra expense, if any, by the Board of Admiralty, th Customs and Coastguard authorities. The Lords of Treasury in 1855 gave it as their opinion that the functio of the Board were not to keep order on shore or afl among the fishermen, or to enforce the observance of c ventions between this country and foreign powers. Th Board has undoubtedly performed good and useful servi especially as regards the collection of statistics for Scotl but these are only partially satisfactory to the nation large. They would be of much greater value had Board been so established as to carry on its work rou the whole coasts of the kingdom, and it ought to be now matter for the consideration of Government, whether would not be desirable to extend its duties as regar statistics and the social condition of fishermen. It wo doubtless form another link in the chain of eviden respecting the migrations of the herring, as the statistics all kinds would follow from place to place round the coast many valuable inferences might be drawn. With the : exception of incompleteness, and the branding ion, the general duties of the Board and its officers ır to be satisfactory and well carried out.

Herring brand, Scotland.

e Herring Brand appears to be the most important ion affecting the Scotch fisheries at the present ent, but it is in reality more a question of commercial iple than a *bonâ fide* fisheries question.

will not be desirable here to go minutely into tics, as they are already very fully published in the ıort from the Select Committee on the Herring Brand, and," 21st June, 1881, and it would simply be a matter ıpying them out, but to deal with the question in a al way.

ere appears to be a division in the trade of Scotland be point, those who desire the abolition of the ling system appearing to be in a minority of two- ı, and consisting principally of large merchants, who hat they would be able to withstand any ill effects ı the abolition might temporarily bring on, and who confidence that they would by superior cure and other s eventually secure for their own brands a sounder g and better prices than they do at the present time ıe system of Government branding. Those who ate the retention of the brand appear to consist pally of the smaller curers and fishermen who have ıe confidence that is possessed by those who advocate olition, and doubtless such abolition would, through ial causes, prevent many of the smaller curers from ng on the business, as they would not at first so y obtain advances from bankers and others. There : no doubt but that when the brand was first adopted a highly desirable thing, as the trade was then in its infancy, and the guarantee of the Government was of great assistance; but now that the trade has gained such a strong footing it is questionable whether its retention is desirable.

There are six different authorised brands:—

The first is for large full herrings, and the brand is Crown P Full."

The second is for herrings of rich quality, with minute roes or milts, and are knowns as matties, or maidens; the brand is "Crown P Matties."

The third is for spent or shotten herrings, and the brand is "Crown P Spent."

The fourth is for mixed herrings; the brand is "Crown P Mixed."

The fifth is for repacked, and is known as "Crown P Repacked."

The sixth is for herrings previously branded with a bung-packed brand, and which have been repacked. It is known as the "Lozenge Brand."

The return of the Board as regards the increased use of the brand shows that for the five years, ending 1880, the average increase upon the branding is 59 per cent., and the increase upon the fishing 41 per cent.

This at first sight tells very favourably for the retention of the brand, but because the demand for it is great by a section of the trade, it by no means proves that from a national and commercial point of view it is desirable to retain it, even though it be self-supporting from a pecuniary point of view.

To many individuals the branding system has been the cause of their success in life, for a cooper now, after working for a master for a few years, can start buying and curing on his own account with a very nominal capital, as no sooner has he cured and got his fish branded than he can to the bankers and get an advance on his parcel to ble him to lay out his money again, whereas without brand he would have to wait for returns. Thomas vies of Great Yarmouth was the first officer in connection h the fisheries ; he was appointed in the year 1635. A ent was granted to him to seal and gauge all red rings according to quality, but it was soon cancelled, as lid not prove to be a step in the right direction, and e its abolition the red herring export trade to the diterranean ports has steadily increased to this day, utes as to quality and cure being almost unknown, ause each shipper sends his fish at his own risk, and ts to his skill in curing to bring him home a good rn ; nor are his packages subject to Government lation, and barrels of all sizes are used ; but he con- s his fish, knowing that he has no Government arm ean on, or brand to guarantee the quality of such con- ment ; and the very fact of his knowing that his rns depend solely and entirely on his own skill, keeps ever watchful and always trying to raise his standard cure, which consequently raises the standard of cure erally.

n the contrary, the brand or Government arm, on which any small curers and fishermen appear to rely, opens eans of conducting the curing with a less watchful eye, to a great extent must be an inducement to many just carry on their curing sufficiently well to obtain the ernment brand, and no more, as they are then enabled et their advances from the bankers, and so continue r business.

nd it must not be lost sight of that although the ding officers are undoubtedly men of integrity and , still, as there cannot possibly be a uniform standard laid down, the judging of quality is left to individual judgment, from which there is no appeal; and as all mortals are liable to err, there can be no reason why fishery officers should be exempt.

Take, for instance, a parcel of herrings, lay down a certain standard you require picked out, and set six individuals of experience to pick them out, and it is highly probable that no two of them will have the same idea of sorting out the standard required; the difference in quality is so small in some instances that it is hard to know where to draw the line.

A very strong and common argument made use of by those who desire the retention of the brand is, that it is not compulsory. True, it is not compulsory, only one must; that is to say, if it is desired to carry on the business at all. It is a strong coercive measure, and the very fact of the majority advocating the retention, and a more extensive use of the brand makes it go harder than ever with those who would endeavour to raise their standard of cure; because the foreign buyer, knowing that there is a Government brand, naturally supposes that it is given only to the highest possible cure of the respective qualities or brands, as he considers the Government would not lend itself to branding inferior articles, or at least should not. If the brand is to be retained Government ought to raise the standard by granting to special cures a higher brand than is now in use; and the argument used by the opponents of the abolition, that those who do not approve of the Government brand as being of too low a standard, can create a higher standard and private brand of their own, and thus make their own trade, is an admission that it is possible to cure to a higher perfection than that which is now permitted to receive the highest Government brand.

The very fact of a barrel being unbranded by Govern-ent tends to make a buyer suspect that possibly it has en refused the Government brand owing to inferior ality or some other cause, though in reality it may be of ecial cure. There is no doubt that in the case of foreign rkets the brand has been of use, for the trade was, recently, a new one, and the capitalists and merchants the Continent were but imperfectly acquainted with e value and qualities of Scotch herrings ; but now, if the and were abolished, there are plenty of merchants suf-iently educated and experienced in the Scotch herring ade to judge the better cures, and the deserving curer uld reap the benefit, and the trade would then prosper its own merits, as others do. What was desirable venty years ago, under certain circumstances, is not quired under the present aspect of affairs; and if anding is such an important and necessary adjunct to a ade with a foreign country, why is it not necessary to ply it to the whole kingdom, and especially to the port trade in red herrings ?

Again, as regards the bankers. They have got into the oove of Government guarantee, and memorialise against e abolition of it. Why should not the bankers, who ke advances of ten times the amount on bills of lading, floating cargoes in the grain, and other trades, demand e same Government guarantee ? In the grain trade, for tance, large quantities of grain are bought for future pment without even a sample being seen by the buyer ; t the contracts are made by specifying the quality, and putes are the exception (but in their event an arbitration use always settles the point), since if a merchant wishes prosper, it will not answer his purpose to have disputes, ich would injure his connection and business ; so he acts up to his contracts to the letter, and those who resort to unfair trading soon meet with their reward in the shape of failure. The answer to the question is, that these trades are firmly established, and the banker, rather than lose business, has adapted himself to the methods and dealings of the merchant; and so it should be with the Scotch bankers, for it cannot be denied that Government has now firmly established the Scotch fisheries, by means which reflect great credit on the originators, and having done so, should leave the general law of commerce to carry on and increase the prosperity of the trade.

Another argument against the point put forward in favour of the retention of the brand, viz., that it is not compulsory, and that those desiring it can effect a higher standard of cure, is, that wherever there are free and open markets in this and other countries, the opening sales of a day or season rule, to a great extent, the prices of sales effected after, and a cargo or two of herrings of inferior quality, sold at the opening sales of a market, always tend to damage, to a smaller or greater degree, the prices of those sold after, notwithstanding that they may be of better quality; so it is with branded herrings. A few parcels of Government-branded will spoil, to a certain extent, the sale of unbrandeds after, irrespective of a possible higher cure, as individual skill and judgment in buying have been so much dispensed with, owing to the Government brand, which really means the skill, and, it may be, too, the impartial judgment of another fallible mortal in the shape of the branding officer. The number of skilled buyers, however, is doubtless on the increase abroad, in consequence of the discrepancies which have occurred in parcels bearing the Government brand, which cannot be denied, as quotations from foreign markets show that on the same day, in the same market, and at the same minute, one parcel branded as "Crown fulls" has been worth two, three, and even more marks, less than another parcel bearing the same brand.

There are many who advocate the retention of the brand on account of its rendering personal skill and attention unnecessary in dealing and speculating in herrings. These are principally bankers and agents, who would suffer, at the very most only temporarily by its abolition, for the small curers would still have to make use of their capital, and it would not take long to establish a system between them for making advances as formerly, as necessity would be, in their case, the mother of invention.

When a Government in the present day interferes with a trade, and goes so far as to lend itself to guaranteeing the qualities simply on the judgment of one man, of an article for which there can be no uniform standard fixed, it is undoubtedly a drawback and check to private skill and enterprise. There are men ready to come forward and effect considerably superior cures, but the obstacle of the Government brand tells them that, so long as that lasts, they would not get properly recompensed for their extra skill and outlay, or at least not without sacrificing a large amount of money (which few are able to do) to fight against an old-established custom (which has the Government of the largest commercial nation at its back), to establish their own superiority of cure, and to guarantee a continuance of that superiority by long repute. Since the Board was first established, and the regulations made as to size of barrels, rapid strides have been made in chemistry and the preservation of food in tins and other ways, and things which our forefathers would have believed impossible in this way are now accomplished facts.

The regulation barrel prevents any attempt at adopting these modern improvements. It is not desirable here to prove what might be done, or how, but simply to call attention to the fact that hundreds of articles of food now in great demand in this country, are neither guaranteed in quantity, weight, or quality, except by the private marks or names of the manufacturers. These prosper solely by their own merits, and this very fact is always stimulating new manufacturers to come forth with improvements; the consumers are, after all, the real judges, and the manufacturers either sink or swim by their decision, and consequently use all possible means to improve their goods; but were they hampered by Government restrictions, as the Scotch herring fishery now is, there is no doubt that the age would not be so progressive as it is.

Just for one instance take sardines, which are imported to this country. There is no regulation size or weight of package, but we, as consumers, soon find which are the best brands, and a bad brand is soon exterminated. Had they been guaranteed by the Government of the country from which they are exported, and we, as consumers, had found that the brand was not reliable, would the sale of them have increased in the ratio that it has? Certainly not, for the consumer would have had his doubts, and have avoided purchasing in consequence.

The complaints which have reached this country from abroad, and which are yearly increasing, from merchants of standing and experience, men of equal integrity with the fishery and branding officers, cannot be overlooked, and evidently prove that on the Continent the Government brand is not so popular as it used to be, thus showing that the former confidence in it is shaken, and that the time is now arrived for a change to be made.

One great argument against the retention is, that if the Government choose to enter into commerce, they ought to do as commerce does, and that is, that if a merchant sends an article guaranteeing its quality, and when it arrives the purchaser proves that it is not of the quality guaranteed, he has a legal claim on the merchant; if the Government have confidence in their guarantee, they ought to be prepared to back it up; but this they refuse to do, or to make any compensation, thereby showing a great weakness, and that the system is wrong somewhere. Statistics and detailed proof might be given on this point, but, as before remarked, these would only be a repetition of the able published reports.

As regards the argument put forward by those in favour of the retention, that weights and measures and standards are necessary for carrying on commerce, it is granted as correct to a certain extent, but thousands of articles of food are sold in this country at a price for the article, weight and quantity not being stated. Our home herring and trawl-fish trade, for instance, is largely carried on without either weight or measure, and each fisherman and merchant makes his packages of what size he likes, and the retailer sells his herrings at so much each. Why, then, should a Government regulation be so essential for a section in Scotland, whose trade does not date back nearly so far as the English trade, and whose transactions do not nearly come up to the English either at home or abroad in quantity? For national statistical purposes, by all means establish a standard, either weight or measure, to sell or calculate the quantity of each kind of fish when first landed, but, after that, let it be for the merchant to do exactly as he deems best for his own business purposes. Those in Scotland who now object to this free trade, would find the benefit of it afterwards, as has been abundantly proved by the prosperity of the English fisheries. The fact that it is the only article in this country of which the Government attempts to guarantee the quality, alone ought to condemn it.

The abolition of it by second-class commercial nations like Norway and Holland, ought to make us condemn it.

Though the curing of herrings at sea is the most expensive method, yet it is by far the best; and though, as a rule, prejudice and opposition would at the present moment ridicule the idea of the Scotch curing ever being carried on in this manner, still, to those who give their attention to the matter without prejudice, it appears to be only a question of time, especially when the rapid development of the Scotch fisheries is considered. The vast improvements both in the size and build of the boats, and the great improvement which has been effected in the gear which they carry, point in this direction, and may be taken as an instance of what private enterprise will do without Government aid. But, suppose that the Government granted a bounty for every boat equipped for the fishing in the present day, should we have seen this rapid development? Everything points to the negative, as the bounty would have been in many instances the chief aim, not the fish, for then a fisherman might have been satisfied with an old small-class boat, which would enable him to catch only a small quantity of fish, and trust to the bounty to make up the deficiency which a better boat would have enabled him to earn. Similar objections would be raised to the abolition of this system, were it in force, as there are to the abolition of the brand. But the abolition of the old bounty system has greatly increased the prosperity of the fishermen. A first-class boat now commands a bounty or engagement money of £40 to £50 (as a commercial bargain) from the curer who engages her for the season, whereas an old boat will have to engage without bounty, though, perhaps, at a higher rate for the fish she may catch. But the invariable result is, that the curer finds he is better off at the end of the season by having engaged a first-class boat, even with a high bounty, as he then gets a good supply of fish, or one as good as the average. Were a Government bounty still given to the boats, the curers would find fault (as the buyers of the cured herrings now do) and complain that the bounty did not stimulate the fishermen to improve the standard of their boats, to the loss of the curers, by causing smaller takes of fish, owing to their not being able to pursue them so far as they might if the boats were better. It is impossible for the Government to guarantee or define a fit and proper boat as well as private enterprise can. The boats descend in age or size step by step, as well as the nets, so that it would be impossible to draw the line of discrimination, and a curer engaging a boat which he had not seen, but simply on the faith of the Government bounty having been granted, might find himself badly served, and would memorialise for the system to be abolished, as has been done in the case of the brand by sufferers and others. But, as it now is, it is a free and open commercial bargain, and is made on its own merits, each party having only himself to blame in the event of a bad speculation, and no Government to make the scapegoat, as now happens with respect to the brand.

Sufficient having been said to show that the abolition of the brand is desirable, the following may be suggested as a means of carrying out such abolition so as to cause the least possible chance of injuring any one. That three years' notice should be given of the same, so that curers might have the opportunity of establishing brands of their own, and thus not be suddenly affected by its abolition, either individually or collectively.

That after the fish have once been landed and changed hands, no Government restrictions should hamper the curers, but that they may deal with the fish where, when, and how they like.

That the Fishery Board should be made a truly national department, by having officers practically acquainted with the trade at every port for statistical and other purposes, to make periodical reports to headquarters on lines to be laid down, and generally to apply themselves for the benefit of the fisheries, and the social condition of fishermen and apprentices, in a similar manner to factory inspectors.

But, on the other hand, if the brand is to be retained, let the present system be altered, and no parcel of fish be branded without having been inspected by three officers at the same time, so that the Government may be prepared to back up what it professes to guarantee. Make it a penal offence for any one who shall "top up" herrings, or wilfully do anything calculated to mislead the branding officers.

rish fisheries.

Next to be considered is the present way in which the fisheries are supervised in Ireland.

In the year 1868 the supervision of the sea and inland fisheries of Ireland was transferred to the Lord Lieutenant of Ireland. This supervision is carried out by means of three inspectors, to each of whom the supervision of a district is intrusted. There is no organised statistical department. Returns for statistical purposes are voluntarily made by the various collectors of customs and coastguard officers, and are only approximate. This is not really satisfactory.

is all that the inspectors have on which to base the statistics which they give in their annual report to the Lord Lieutenant. The laws, as far as the sea fisheries are concerned, are not in the most desirable state. With a view to amend these, a Bill was introduced into Parliament in February, 1882, which had for its principal objects:—

To appoint fifteen Commissioners, who should be a body corporate, and having a common seal.

That they should make reports to the Lord Lieutenant and to Parliament.

That they should have power to make bye-laws for the regulation of the fisheries as to the mode, manner, and time in which they should be prosecuted, to hold inquiries, to issue licences and to revoke the same, to make advances of money, to have the supervision of the fishery piers and harbour works, instead of the Board of Works.

One very absurd clause was inserted, to the effect that no vessel over five tons should fish in any estuary waters adjoining the coast of Ireland. At the same time the coast was not defined—it might mean one or ten miles from the shore. It was further proposed that the Commissioners should have power to hold inquiries into the efficiency of the vessels employed. To a certain extent legislation of this kind may be desirable for Ireland, but it would not be suitable or practicable to apply to east coast, foreign, and other vessels, which resort to the Irish coast for the purposes of fishing at various seasons. This must soon have been discovered by the framers of the Bill, who withdrew it, and in May last, just three months after, introduced into Parliament another Bill on similar lines, but omitting all the parts which set out the proposals for the objectionable licences, bye-laws, &c., before named. This Bill was also withdrawn. Therefore in three months two Bills for the regulation of the Irish fisheries were introduced into Parliament, and as quickly withdrawn. This all points to the desirability of legislation to promote the fisheries, but shows a lack of something which should enable it to be suitably framed. It is high time that the Government should recognise these facts, and form a Fisheries Board embracing the whole of the United Kingdom, which could meet and discuss the desirability of fresh legislation, instead of having three Boards at work, each framing legislation to suit its own wants, totally ignorant as to what effect it may have on other portions of the fisheries, or those prosecuting them. The migration of boats nowadays hundreds of miles from their own ports to others renders it necessary that all should be consulted, even before local legislation is framed. The counsels of one or two theoretical gentlemen should no longer be allowed to prevail at headquarters, but a department or Board should be formed, composed of both theoretical and practical men, with vessels at their disposal for scientific and experimental purposes. It is all very well for the Board of Trade, as the present system is, to hold inquiries, when it wants information, from fishermen, but these cannot afford to lose time, or make experimental trips and hauls for the benefit of the community at large. This should be the work of the Government, and is one which has been undertaken by other Governments long ago, with the result that we are behindhand in our knowledge of fish and fisheries.

Packages.

Of necessity in this trade packages are much more exposed to loss than in any other. They are sent hurriedly from market to market, and are removed by unscrupulous persons for all sorts of purposes, not theoretically illegal, but practically so. The loss in these amounts to many thousands of pounds in a year, and is an indirect tax on the consumer, as neither the catcher, buyer, merchant, nor salesman can afford to bear the heavy loss. Some special clauses relating to fish packages might, after due consideration, be very beneficially introduced into any future fishery bill to the pecuniary benefit of the consumers.

Suggestions.

Having now dealt with the effect of the present and proposed legislation, it only remains to make some suggestions for the improvement of the laws, beginning with some general ones.

First,—That the Government should at once organise for the whole of the United Kingdom a fisheries department.

This is desirable at once, because if the present authorities who have power to legislate for the fisheries go on blundering, especially on international questions, foreign nations as well as ourselves will lose confidence in future proposals, and much injury will accrue to the industry, and loss to the nation.

Special reference is here made to the want of clearness in the convention of 1868; the ordering of cubical space, and sanitary arrangements for crews of decked fishing boats, which was immediately abandoned as impracticable; and the lights question, which in its various phases has caused considerable unnecessary expense and annoyance to owners, and which is now virtually abandoned.

The order in council, which compelled open-coast fishing boats to be lettered and numbered, in the same way as large vessels (in size of the letters and numbers as well), and was abandoned as useless, after causing much trouble and expense to the poorest of our fishermen for several years.

The law which compelled fishing vessels' crews to be shipped under an agreement for a home trade ship, and which was to a great extent useless and inapplicable to fishing vessels.

The way in which the Act of 1880 was drawn up and passed, under which the industry has suffered so severely, without including the immense loss to the nation at large.

The way in which the International Convention of 1882 is drawn up.

The fishing vessel agreement sanctioned by the Board of Trade in March, 1882.

The draft of clauses proposed to be inserted in the Merchant Shipping Act, 1882, which have been discussed and speak for themselves.

All these blunders could have been avoided had we, like other nations, an organised fisheries department. The Board of Trade, which legislates for the fisheries, has not on its staff a single practical fisherman, or even any one who knows the common rudiments. What would be the result if a man trained as a fisherman was chosen to practically advise a department on shipping matters? The reply is—Blunders. The same argument then may be applied *vice versâ*.

Second,—That the laws relating to sea fisheries should be kept entirely distinct from any others, except so far as having one general rule of the road at sea, and its consequences, for all classes of ships and boats, at least when under weigh or under full command.

There is a wide difference between an industry in which the surface of the sea is simply used as a highway, and another where the sea is used both as a highway and a ground for gathering in rich harvests. In the former a knowledge of surface navigation only is required; in the

e bottom navigation of the submarine hills, valleys and pits is required in addition, the sea itself being common to both only as a highway. Ships may be likened to common carriers using a high road, and fishing vessels to the harvestmen working in the fields on either side of that road. Their occupations are totally different, and so are the laws relating to those occupations, and they are embodied in different acts, but on the highway the law is the same for both. A similar method of legislation should be applied with regard to merchant ships and fishing vessels.

Third,—That the department should consist of theoretical and practical men, assisted by two or more practical inspectors. The duties of this department should be the collection of statistics, the carrying out of experiments, and the framing of such legislation for the fisheries as may from time to time become necessary. The inspectors should be required to watch and take notice of any changes or innovations in the method of prosecuting the fisheries throughout the kingdom, to make special enquiries and go to sea when necessary, to carry out experiments, and to report thereon to the department.

Fourth,—That the whole of the shores of the United Kingdom should be divided into districts, and an officer or officers appointed for each district, whose duties should be the supervision of the fisheries, and that all reports, disputes, permits, and salvage of fishing gear, should be dealt with by them, subject to appeal where points of law were involved. They should collect statistics and make a general report quarterly to the department on all matters of interest to the fisheries which might come under their notice.

Fifth,—That having secured the assistance of practical men, the fisheries laws of the United Kingdom should be once, *and not till then*, wholly revised to suit the peculiar requirements of the industry.

Sixth,—That the International Convention of 1882 be not ratified till it has been revised, as far as practical detail is concerned, by an International Committee of practical men, and finally approved by the plenipotentiaries.

These general suggestions will cover the whole of the minor suggestions of detail which have been made throughout this essay, but it will not be out of place here to give the heads of them and others briefly :—

1. That steps be at once taken to prevent the destruction of immature fish by trawlers.

2. That the question of damage done by one vessel to another or their gear should be settled without the delay now incidental to such cases, especially where foreign vessels are concerned.

3. That the law of registration as to tonnage should either be abolished as far as fishing vessels are concerned, or carried out properly, and a definition given as to what constitutes a decked fishing boat.

4. That proper forms of agreement to suit the various classes of fishing vessels be framed, but that they be as simple as possible, and that the signatories to such agreements be compelled to carry them out.

5. That the apprenticeship system be fostered with judicious supervision, and the reputed masters made masters of the apprentices *practically*.

6. That the system of licensed lodging-houses be adopted at all ports.

7. That the payment of crews be not liable to official interference, except in cases of dispute.

8. That no alteration be made in the present system of provisioning fishing vessels.

9. That at fleets the admiral for the time being be invested with powers to decide as to when the boarding of carriers

shall or shall not take place, and that the master of any vessel who permits his boat to be got out after the signal not to board is given, shall be liable to heavy penalties, and to manslaughter in the case of loss of life occurring from such conduct. Reports of infraction of the law to be made either by the admiral, or master of carrier, or both at the earliest opportunity.

10. That some regulation be made as to the number of packages or weight a boat shall carry. The master of vessel to be responsible for any infraction of this.

11. That all admirals should be remunerated on a scale of fish caught only, not landed or sold, so that no loss will accrue to admiral by not allowing fish to be boarded in bad weather.

12. That trawlers and liners be authorised to carry one white light at masthead when at their gear.

13. That severe penalties be imposed on the masters of all vessels not carrying their proper lights at any time, whether damage is done or not, and that the various cruisers be specially instructed to look out for such offenders.

14. That drifters be authorised to carry two white lights, 5 feet apart, perpendicularly, when adrift or at work.

15. That necessary clothes supplied to a man by an owner, to enable him to proceed to sea, be deemed ship's stores until such time as such fisherman has earned sufficient to pay for them.

16. That a single trip be not termed a voyage, but only a portion of such voyage.

17. That the law touching the selling of fish by auction be revised as far as the first sale of fish only is concerned.

18. That the old Act of 1854, as regards desertions, be at once re-enacted.

19. That appeal in salvage (fishing) be made to the magistrates only, assisted by competent assessors.

20. That the law of lettering and numbering of vessels be carried out properly.

21. That permits be issued in cases of borrowed sails or gear.

22. That no legislation be enacted by order in council.

23. That in ferrying fish, or other boat work, the mate of the vessel should always take command of the boat when the master does not.

24. That a closet seat be provided on every vessel, such as is now provided in a very few vessels, as many lives have been lost both in harbour and at sea, either through the vessel lurching or other causes, through sitting on the rail. This would save many a life by its being inboard. Two iron loops also might be screwed to deck to put toes in, to give a hold.

25. That regulations be made as to the buoying of telegraph cables on fishing grounds, and when it is necessary that they should be put down, to ensure that no unnecessary delay takes place in removing them, as is sometimes now the case.

26. That one or more fishing cruisers should be equipped and devoted to scientific investigation or practical experiments, similar to those carried on by America and other nations.

27. That a code of signals should be established, so that at night cruisers could be signalled for when required.

28. That extraordinary punishments be enacted for offences which oblige a fishing vessel to return to harbour, such as cutting a trawl-warp, throwing capstan handles overboard, &c., which are similar to rattening in factories.

29. That the branding system be abolished.

30. That the present Scotch Fishery Board form a portion of a general system throughout the United Kingdom on revised lines.

31. That the present Irish Fisheries' Commissioners also form a portion of the proposed general Board.

ADDENDA (1).

Submarine telegraph cables.

An important point, and one which is daily increasing in difficulty, must not be forgotten; it is the question of submarine telegraph cables. It is a daily increasing one for this reason, that the submarine cables which were laid quite as an innovation a few years back, are now beginning to get old and worn, and consequently require much more attention and repairing than they did during the first few years of their existence. This difficulty will increase rather than diminish, as new lines of cable are constantly being laid on various coasts. As matters now stand, there is no law bearing on the point. A company lays a cable which, while it lasts good, will cause many a vessel to lose her anchor, should she be unfortunate enough to hook it, but as soon as the cable begins to get old, thin, and weak, it breaks on being hooked by an anchor, and the company begins to call out about damage to cables. A repairing steamer is sent which grapples for the ends, and finding possibly that the cable is in a bad state, takes up a certain length of it, puts buoys on to the ends left, without any notice of any kind being given to any authority. She then goes away to obtain a piece of cable to repair it with, or to a harbour to overhaul it, with a view to splicing and cutting out certain portions before relaying it. This is necessarily a work of time, as each splice occupies three hours, not reckoning the getting out and re-shipping. A fisherman, not knowing this, shoots his nets in what he believes to be clear sea-room, and finds during the night that they are parted and damaged, or lost, through what he afterwards finds is the buoy or buoys left by the repairing telegraph steamer. Thus far individuals have not attempted to recover damages by a lawsuit against a wealthy company, the law on the subject being very undefined; so, by "might against right," the telegraph companies have at present the best of it. Latterly, in some instances (this year, 1883), notices have been issued by them that "buoys have been laid"—not "are going to be laid"—in certain localities, with a view, no doubt, to assist in protecting themselves against actions for damages; but they carefully avoid dating them, so that the period for which the buoys are to remain cannot be ascertained. Water and gas companies have power by Act of Parliament to break open roads and streets to effect necessary repairs, but, on the other hand, they are bound to give proper notice of the time and place; a similar basis should be taken in framing legislation for the telegraph companies. In some cases the buoys remain for weeks together, simply because they do not choose to carry sufficient new cable with them to lay in the place of what they take up when the weather is fine, but come to harbour to overhaul the old piece taken up, to splice the best of it together, and relay as much of the old as possible. Therefore, to suit the pockets of the companies, fishermen are precluded from fishing in the locality of the buoys during the will and pleasure of the manager or engineer of a telegraph company. This is not right. It is granted that there must be telegraph cables, but, as regards repairs, the companies should be compelled to use every means in their power to effect them rapidly, instead of doing them piecemeal to save their own pockets, to the detriment of others, especially in cases where they have duplicate and triplicate cables, and are consequently in no great hurry. Powers should be given them to lay buoys, if necessary, for the repairs, but they should also be bound to execute them in a suitable and expeditious manner after due notice has been given. Recently the telegraph companies addressed a letter to the Board of Trade suggesting the enactment of certain provisions for the protection of their cables. They asked for penalties to be imposed for wilful damage to cables either by anchorage or gear; and, on the other hand, offered to compensate vessels for loss of anchors or gear in cases where they were lost to save damage to cables. This would put the whole affair into the hands of the companies, for they would be at liberty to dispute any claim they liked, and the practical result would be victory for them, as individual owners possessing, as a rule, only moderate means, would rather bear the loss than go to law with a company. The companies should be compelled to exhibit in prominent places at fishing ports, charts showing the route of the various lines of cable belonging to each, and their bearings. These should be corrected from time to time, as they may be underrun for the purposes of examination or repair, as each time this process is gone through the position of the cable is altered to a certain degree according to circumstances, such as tides and winds. They should be also compelled to have a sufficient number of cables laid, so that if one gets broken the repairing would not be so urgent as to prevent them from giving proper notice of their intention to commence repairing, and of the probable locality, on a certain date, or as soon thereafter as the weather will permit, or to effect the repairs at seasons when no drift-fishing is being prosecuted in the localities where the cables are laid.

ADDENDA (2).

Fisheries inquiry, 1882.

Since this essay was drafted, an inquiry into the sea fishing trade generally has been held by order of the President of the Board of Trade, on the following grounds:

First.—In consequence of questions and difficulties that have arisen.

Secondly.—In consequence of cases of cruelty to boys on fishing vessels which have been brought to light.

The former fully bears out what has been remarked in this essay, and its introduction shows that the Board of Trade, as at present constituted, is not conversant to any great extent with the fishing trade, or at all events not sufficiently so, as to be able to legislate for it successfully. It also shows that the abolition of imprisonment for desertion was effected regardless of the interests of the trade or its effects upon it, and solely, as the President told the deputation that waited on him on the question, because trades unions did not approve of it. He evidently tried to humour the trades unions, who know nothing of the extraordinary circumstances under which the fishing trade is carried on, regardless of the damage and loss which would accrue to the trade and nation. Having taken this hasty step, he afterwards appointed a committee to inquire into "the general regulations and customs under which the fishing trade is worked at the present time." Had this been done at first, it would have shown a much more sincere desire to benefit the trade, and is only what any trade has a right to expect at the hands of a Government department. The minute appointing the Committee then goes on to state that the "draft clauses" (already discussed) have been drafted with a view to their introduction to Parliament. The Committee nominated is then instructed to report

1. "Whether the draft clauses referred to are sufficient, or whether they need any, and, if so, what modification."

2. "Upon the causes of the numerous desertions that are reported to have taken place among the crews of fishing vessels, and to suggest any remedies for the inconvenience alleged to have been suffered in consequence of the abolition of arrest without warrant, and of imprisonment for breach of contract."

This latter clause is neatly worded as far as "remedies for the inconvenience alleged to have been suffered" is concerned. The President does not mention "the pecuniary loss," which was amply proved by dates, facts, and figures in detail to be thousands of pounds, by the deputation from the fishing trade of all parts which waited upon him in the month of July previous. The minute closes with the following advice:—

"The Committee will consider and report on any practical suggestions for obviating this inconvenience, which is likely to be most serious at the commencement of the new system, and before employers and employed have settled down to new conditions, but they will be good enough to consider themselves as precluded from entertaining any proposals for reverting to the old system which has been condemned by Parliament, and which Her Majesty's Government are unwilling, under any circumstances, to re-establish."

Here is shown a determination, even to the annihilation of the industry, not to re-enact the old system, by the head of a Government department, who is on the point of having an inquiry upon "the *general* regulations and customs" under which the industry is worked. A department might be excused for wanting an inquiry into any special circumstances connected with an industry, but when it wants information on the "general regulations and customs," it shows an incredible amount of ignorance. It is a case of legislating first, and inquiring afterwards as to the effects and damage done. The Committee consisted of four gentlemen with whose appointment the trade was well satisfied, but a general opinion prevailed that the fifth, who was an official of the Board of Trade, should not have been an actual member, though he might have watched the evidence on behalf of his department. The Committee took great pains to get at the bottom of the whole system, but found a difficulty in getting boys and crews to come forward and speak freely, the proportion of this class who gave evidence being very small. Fishermen, like sailors, do not like public inquiries, and the department will never get at the bottom of the whole trade in this manner; it must have practical men on its staff who can keep it informed on such matters as can never be got at by public inquiry. The Committee received evidence at the following places:—Hull, Grimsby, North Shields, Scarborough, Yarmouth, Lowestoft, Ramsgate, Penzance, Brixham, and at the Board of Trade. The trade, at certain ports, was prepared to take the draft clauses and show their utter impracticability on certain points, but in reply to questions put to the Chairman, he stated that, from evidence previously taken, the trade might consider the draft clauses in their present form virtually abandoned. This, again, is an instance of the ignorance of the department of the working of this industry, though happily, owing to the indignation of the rade at the passing of the Act of 1880, the draft clauses lid not become law in the same way.

The report of this Committee was published in the early art of the present year 1883. It is a very able one from a eneral point of view, and as far as the recommendations re concerned they agree mainly (on the points gone into) vith those previously given in this essay. There are one r two points in the report which will bear a little omment.

Clause 52, referring to certificates and other matters, and the vessels which shall be liable to or exempt therefrom. It seems rather strange that the recommendation should be according to tonnage, for this in no way guarantees the safety of the vessel or her crew if smaller than the regulation tonnage. It appears to the writer that this should not be according to tonnage at all, for the following easons. A certificate is hardly required where a fisherman s always fishing from the port where his home is and the essel belongs, and with which locality he is well acquainted or many miles round, but it does appear desirable in ases where a fisherman is going to make a voyage of everal hundred miles, as before shown, such as east coast cotch boats sailing to the east coast of England, or west oast of Scotland; east coast English boats going to the orthern or western ports of Ireland, or west coast boats oing to the northern ports, and so on. In most cases hese voyages are made only once a year. If the weather favourable, all is well; but suppose it is not, and the essel is unable to keep the coast, how is the master to now where he is unless he is educated to a certain extent? n many cases now it is "happy go lucky," as well as with ome of the North Sea trawlers. An instance occurred only cently of a master cutting away his trawl gear in the open sea, thinking that he was driving on the Dutch coast. When daylight came he found out his error, and then tried to frighten the boy not to tell the owner how the gear was lost; but this is only one case out of many. Boats of under twenty tons get lost on their passages, with all hands, but whether from incompetency or not must be left open. If the masters held certificates, it would then take away all doubt as to whether it was through incompetency or circumstances beyond his control. Men who act as pilots of fishing boats on various coasts should also be compelled to have certificates for general competency if masters are. But to return to the point: these stipulations may, if desired, apply to vessels not exceeding twenty tons net register, but in addition they should apply to all vessels leaving their own port for the purpose of prosecuting a fishing from any other port if beyond, say twenty miles, for there are frequently plenty of fishing vessels smaller than twenty net tons register which go hundreds of miles from home to prosecute various fishings. Surely if vessels over twenty tons fishing from their home port only are required to have certificated masters and mates, vessels leaving home as mentioned should also be required to have the same, if only as a guarantee for the safety of their crews.

The next point for remark is the recommendations on the desertions question.

Clause 55, section 1, recommends the issue of warrants for the apprehension of deserters. This is very good if the warrants can be obtained within a few minutes; but where a fishing port has two miles of quay, by the time the warrant is obtained the deserter may be miles away in the train. If, on the other hand, they can be obtained instantly, which they must be to be practically useful, it will simply be the system of arresting a man on the spot, but with the doubtful satisfaction to him that he is arrested under a warrant.

Section 2 recommends that the offender should have a preliminary trial before the Board of Trade officer. The use of this would practically amount to the old law, for when the Board of Trade officer ordered the deserter to be taken to the magistrates there is no doubt but that, as formerly, in most cases the man would proceed to sea. The principle appears to be the same with a little more red tape added to it; for if the offender were not guilty the Board of Trade officer would not condemn him, nor would the magistrates if the case had come before them. It does not appear to relieve the fishermen from the old ultimatum of imprisonment for desertion, which is professedly to be abolished, but simply to put a little extra form in the way in the shape of a Board of Trade official. Looking at this in this straightforward manner (which has a parallel in the professed abolition of imprisonment for debt, where, because a man does not pay what he has not got, as ordered by the Court, he can be imprisoned for contempt of Court (?)), and then reading the final advice to the Committee in the minute before commented on, it does not appear likely that the President of the Board of Trade will see his way to adopt it. One thing appears strange, and that is, that the Board of Trade official, who formed one of the Committee, should have concurred in this portion of the report, and even suggested it to witnesses who gave evidence, as a way out of the difficulty. The writer cannot conclude this essay without adding a little more which has since occurred to him on reading the report of a speech made by the President of the Board of Trade in reply to an influential deputation of shipowners which waited on him early in this month (March). To a great extent, though not altogether, the interests of shipowners are identical with the fishing owner as regards desertions. The President said: "With respect to the desertion of seamen, I understand that there is only one change which can be satisfactory to you, and that is, that the anomalous power which was once possessed by shipowners alone of all employers of labour, that of arbitrary arrest without warrant, should be re-enacted. All I can say is, it will not be re-enacted by me, and I will have no part in restoring legislation which I think cannot by any possibility be justified." This being the President's view of "the anomalous power possessed by shipowners alone of all employers of labour," why did he not carry out his principles thoroughly when framing the Act of 1880? What other employer of labour has the power which the Board of Trade still puts before owners as their remedy, that of allowing an owner to appropriate a deserter's clothes or effects, which he may leave on board, and which would include a fisherman's oily clothes and sea boots, without which he cannot go to sea, and which are in reality his tools? Suppose a workman left his work, or neglected to attend to it for one day, and a coat, cap, slop or tools left in a factory were seized by the master, the result would be that the master would have to pay all damages in a court of law. Again, in what trade would a man be liable to pay the excess of wages paid by his master to another man whom the master might engage in his place when he left his work? Or in what calling would a man be liable to four weeks' hard labour for refusing to do as he was told by his master, and to forfeit wages as well? For assaulting his master, to be liable to twelve weeks' hard labour without the option of a fine? For combining with others to neglect duty, twelve weeks' hard labour? For embezzlement or damage, to twelve weeks' hard labour, in addition to paying for the

Desertions.

damage? Or, as in the Act of 1880, in what trade can a man who refuses to do his work be lawfully taken to it by force, by his master, his foreman, or police? The reply to all these is that they are anomalous, and "possessed by shipowners alone of all employers of labour." Therefore, according to the President's views, they should be repealed at once. But in the Act of 1880 he created a fresh anomalous power of "conveying on board," it might be, a drunken man (unable to appeal to be taken before the magistrates) compelling him to go to sea in an unseaworthy ship or otherwise forcing him to his work. This is an anomaly for the President to explain. Either this trade requires anomalous legislation or it does not. The President seems to say it shall not have it. As he distinctly refuses to assist in getting the anomalous power of arrest without warrant re-enacted, therefore let the whole of the "anomalous powers possessed by shipowners alone of all employers of labour" be repealed. But, on the other hand, if he admits that anomalous legislation is required, as he does by the sanctioning of it in the Act of 1880 above referred to, let the trade have such anomalous legislation as has been amply proved to be the only suitable kind, and which may possibly help to save some of the lives of which the President further on in his speech deplores the loss, by guaranteeing that our ships and fishing vessels shall be efficiently manned with their full complement of trustworthy seamen, and not be shorthanded, or manned by loafers, on account of the efficient hands selected by a master or owner being allowed, after having been lawfully shipped, to break their agreements for their own private whims and fancies.

Life-saving.

This calls to mind the way in which the question of life-saving is dealt with by the Board of Trade. It is part of the duty of this department, and to carry it out it has power, under subsection 5 of section 418 of the Merchant Shipping Act, 1854, to devote the moneys of the Mercantile Marine Fund to "such expenses for establishing and maintaining on the coasts of the United Kingdom proper lifeboats, with the necessary crews and equipments, and for affording assistance towards the preservation of life and property in cases of shipwreck and distress at sea, and for rewarding the preservation of life in such cases as the Board of Trade directs." This duty is very efficiently carried out as far as coast life-saving by rocket apparatus provided by the Board of Trade is concerned, and in the event of life being saved, the award to the coastguard, who receive Government pay, and have no expenses for apparatus, is £1 per life saved. This is not grudged for one moment, but the Board of Trade might do a good deal more in this way. Our North Sea fishing vessels have been well named the "Life-boats of the North Sea," and no year passes without many crews being saved by them and taken into some of our east coast ports. They are generally saved at great risk with only what they stand in, and it would be interesting to know, if this department could give it, how many lives have been saved by this means during the last ten years, and the amount the salvors have received out of the Mercantile Marine Fund for such service. It appears that the department does not encourage this at all as it ought. If it is necessary to pay lifeboat crews, surely smacks and ships saving lives should be entitled to some reward. These men cannot live on nothing, besides risking their lives, any more than a lifeboatman. A smack will rescue a crew, sometimes of fifteen hands or more; all she can then do is to make for home and land the rescued. The vessel to which they belonged is most probably entirely lost, so that there is no salvage of property, and the smack loses two or three nights' work. The question is often asked, "Why don't you apply to the Board of Trade for some recompense for loss of time?" The reply always is, "It is of no use." If such is the case, it is high time that it was of use. How often are shipwrecked crews brought in who report that one or two vessels (it may be in the Atlantic or elsewhere) passed near and took no notice? It points to the fact that there is a sort of dread among some masters, that if they rescue a crew, and have to make the nearest port and get more provisions, they will not be thanked by their owners, and in some cases they have to pay for the extra provisions out of their own pockets. It is the same thing as driving steamers in a fog. A good owner forbids it, a bad one finds that his master is careful and stops, and consequently the master is told he is not wanted any longer. The same pressure, in certain cases, weighs as to rescuing crews in distress. The master may wish to do so, but, looking to his own position, hopes that they will get saved by some other means, or smothers up his feelings by thinking that some other ship will be sure to save them. It is painful to have to write such facts as these, but there are good and bad all over the world, and the writer is only too sorry to feel convinced that in some cases masters of ships have to study their own families and position. This really is a Government question, and from the interest which the President of the Board of Trade evinces in life-saving, it is to be hoped that he will notify, that all future cases of rescuing crews in distress will be duly considered, if reported to him, and rewarded according to their merits. Surely this would be only fair where private enterprise finds the means, and often the necessaries, the Board of Trade having no expense as in the case of maintaining rocket apparatus.

Immature fish.

A few words on the immature fish question are desirable. The writer believes that all practical men are agreed that the question is to be settled, not, in accordance with the view put forward by some, by the depopulation of the sea of, at least, certain kinds of fish—though this can never be, owing to the large extent of grounds, rough or otherwise, which nature has given as a protection to the fish, and which are consequently unworkable—but in accordance with the view that, while it is impossible altogether to prevent the destruction of immature fish, steps should be taken as far as possible to minimise it.

On the Dutch coast, at the period of the year when large quantities of smacks work there, it is a common occurrence to have to use a shovel to throw overboard not only the dross, shells, and refuse of a trawl-net, but thousands of small soles and flat fish, in one haul only. It is a serious international question, but resolves itself at once into a question of nets. Our Government should lose no time in getting a net so constructed as to minimise this wasteful destruction. They should, as before remarked, give practical men the opportunity of testing the value and results of various ideas, and a suitable net would soon be found. Till this is done, the evil will continue, for, as before remarked, private enterprise cannot afford to pay for such experiments as these. It is to be hoped that the present Exhibition will do much in this direction.

Insurance.

Fishermen, like sailors, are proverbially improvident, as the various relief funds, which have been from time to time raised, amply prove. The writer, being well acquainted with the distress and want often caused, is firmly of opinion that this should be a Goverment question, as to whether some fund could not be raised by a small compulsory payment by crews to it, from every £100 earned. In deducting expenses it would never be missed. Very often the majority of a crew are in favour of giving a donation out of the gross earnings to some relief fund which may then be open, but are prevented from so doing by the "odd men" before alluded to, who perhaps will never go to sea again, or have no homes, and therefore feel no interest in it.

SALMON LEGISLATION IN SCOTLAND.

THE LEGISLATION

AT PRESENT APPLICABLE TO THE

SALMON FISHERIES IN SCOTLAND,

AND THE

BEST MEANS OF IMPROVING IT.

"*TRUSTY AND BYDAND.*"—J. M. LEITH, EDINBURGH.

VOL. I.—E. 3.

SALMON LEGISLATION IN SCOTLAND.

WHEN a country is endowed by nature with a valuable product it of course becomes her bounden duty so to watch over it by wise and prudent regulation from time to time as to preserve and if possible to increase its importance both as a national and as an individual source of wealth. When, in addition to its commercial value, it possesses the economic and dainty qualities of the salmon as an article of food, that duty becomes doubly imperative. It accordingly does not surprise us that our ancestors were of the same opinion, and to find in our statute books protective enactments dating at variable intervals from the present time as far back as the reigns of Robert the Bruce and William the Lion, *i.e.*, for no less than eight hundred years, or at all events not far short of that extent of time.

It is not necessary to discuss these early statutes, which, though most of them are still nominally in force, are practically in desuetude; but we think it deserves to be said, particularly of the earlier ones, that, apart from an occasional looseness of expression which was unavoidable considering the state of education and civilisation of the times, they for the most part show clearly the intention of the framers, and a spirit and determination with regard to unfair and severe modes of fishing, which are worthy of our

HOME DRUMMOND'S ACT.

Coming down to the 19th century we find that an Act (9 Geo. IV. c. 39) was passed in 1828, being the first Act relating to Scotch salmon fishings since 1705, a period of one hundred and twenty-three years. This Act is generally known as "Home Drummond's Act," and is still partially in force. It contains several provisions intended for the preservation of salmon, the most important of which postponed the commencement of the annual close time, and extended the whole period to one hundred and thirty-nine days. Previous to this the close time lasted only for about one hundred and seven days, though it commenced earlier. It was regulated by an Act of James I., 1424, c. 35, the provisions of which were merely confirmed or re-enacted by other Acts passed between that date and 1705. This Act of 1828 is generally considered to have done much more harm than good to the fisheries, because, instead of protecting them by prohibiting netting at the time when netting was most destructive, viz., at the end of the open season, it actually withdrew the protection which formerly existed, and permitted netting to encroach for three weeks (August 26 to September 15) into what had before been close time. The nominal extension of the close time to one hundred and thirty-nine days, therefore, was illusory, the addition being made at the beginning of the former open season, when it was unnecessary, or of little consequence. The Act also made no concession to the upper proprietors, by permitting rod-fishing to go on for a week or two after the nets were stopped, and thus the upper proprietors were not encouraged to afford any protection to the fish while breeding in their waters. Taking into consideration the fact that only three years before a Select

Committee of the House of Commons appointed for the purpose had made an exhaustive inquiry into the subject, and had presented a Report to the House containing recommendations superior in every respect to those actually adopted, it is difficult to understand why the Act was passed, and it can only be put down to the adverse influence of the lower proprietors. It was entirely in their interest, and not in that of the fish or the fisheries.

Of course it was not to be expected that matters could remain on the footing established by this Act, and accordingly many proposals were made, and several bills brought forward from time to time during the next thirty years with a view of amending the law and placing it more or less nearly on the footing recommended by the Report of the Select Committee of 1825. The same influence, however, which secured the passing of the Act of 1828 was still at work, and defeated every effort which was made. The way for a new general Act for Scotland was at length paved by the passing of two Acts for the Tweed in 1857 and 1859, the Tay Act of 1858, and the Ness and Beauly and Thurso Acts of 1860, the discussion of the Bills for which, notably those of the Tweed, opened the eyes of Parliament to the real state of matters, and to the necessity of doing something to prevent the extermination of the "noble denizen of the rivers."

BILL OF 1861.

In 1861 the whole subject of salmon fishing legislation in Great Britain came before Parliament. Following in the case of England on the recommendations of a Royal Commission, and in the case of Scotland on those of a Committee of the House of Lords, two important and comprehensive Bills were introduced, proceeding on almost the same lines, and proposing *inter alia* in both cases the abolition of "fixed engines," and the extension of the close time. The English Bill was passed with no material alteration, but the Scotch Bill, after having been subjected to the tender mercies of another Committee (of the House of Commons), which unfortunately was not, as it should have been, entirely disinterested, was so altered and mutilated, that its introducer, the Lord Advocate, did not know it again, and consequently withdrew it. The *vexata quæstio* which mainly caused this result was the abolition of fixed engines, and seeing that the opposition on the point was so strong against him, the Lord Advocate (Moncreiff) prudently decided to defer its discussion to a more convenient season, and to secure in the meantime other important improvements which there was more chance of carrying. He therefore brought in a Bill with this view in the following year (1862), which was finally passed after undergoing a certain amount of alteration. The question of fixed engines was left open, with the stipulation that nothing in the Act should be held to legalise any mode of fishing which had before been illegal, a proviso which had been rendered all the more necessary by an attempt of the Committee on the Bill of 1861, to legislatively acknowledge fixed engines, under cover of subjecting them to certain restrictions.

THE ACT OF 1862.

This Act of 1862 now forms the foundation of the present state of the law of salmon fishing in Scotland, though not so completely as the corresponding English Act of 1861 for England, which repealed all the existing statutes on the subject, a serious omission in the Scotch Act. It will be useful to give a short resumé of the provisions of the Act.

Summary of Provisions.—The Act (1) constitutes each river, with its tributaries, lakes and estuary, and adjoining sea-coast into a district; (2) appoints commissioners to fix boundaries between estuaries and sea, and between upper and lower proprietors on rivers; limits of districts and of annual close time, and to make general regulations regarding cruives and obstructions, meshes of nets, and due observance of weekly close time; (3) Fixes annual close time of one hundred and sixty-eight days for every district, and weekly close time of thirty-six hours, with qualifications as to rod and line, the annual close time being applicable to every mode of fishing in river, lake, estuary and sea, except rod and line, during extension to be fixed by Commissioners; (4) Imposes penalties, with forfeiture of articles used, for fishing during close time, or with illegal mesh of net; for obstructing or impeding passage of fish; for selling fresh fish taken during annual close time; for taking or possessing foul or unseasonable salmon at any time; for fishing with lights; for setting nets or traps to catch fish leaping at a fall; for using or selling salmon roe for purpose of fishing; and for polluting waters; (5) Enjoins Commissioners to make bye-laws on matters committed to them, which (after certain steps) should have all the force of law; (6) Provides as to election, constitution, and powers of District Boards; (7) Declares illegal fishing by three or more persons at night to be a criminal offence, punishable by fine or imprisonment; (8) Provides for prosecutions, and recovery and application of penalties and expenses; (9) Extends the English Act of 1861, as to fixed engines, to the Solway after January 1, 1865, a provision which, however, has proved abortive. The Act does not apply to the Tweed, with the exception of three sections, relating to illegal modes of fishing (saving clause), possession of salmon roe, and poaching by three or more persons at night.

The Commissioners appointed in terms of the Act, after inspections and inquiries lasting over two years, marked out one hundred and five districts to be supervised by the District Boards provided for in the Act, and made bye-laws regulating the various matters above mentioned (except obstructions).

FAILURE OF DISTRICT BOARDS.

It is universally admitted that the reforms introduced by the Act of 1862 were necessary and well-intentioned, and that they have been generally beneficial to the salmon fishings; but however excellent in intention any piece of legislation may be, it unfortunately too often happens that its effect falls far short of the same standard of excellence, and this Act is no exception to the rule. One of the most important of all the provisions in the Act was the establishment of a responsible and interested supervision and regulation of the fisheries, by means of the constitution of local boards of proprietors of salmon fishings, and the delegation to them of apparently ample powers to carry out the intentions of the legislature. There can be no room for doubt as to the wisdom of this principle of government of the fisheries, but nevertheless in the result we have the most conspicuous failure in the whole of the Act. As already mentioned, the Commissioners appointed by the Act, following strictly its instructions, constituted one hundred and five districts, in each of which the proprietors f fishings should have met and formed District Boards. n some of the most important districts they did meet and oards were duly elected, but in the other districts the arties showed themselves so very apathetic that the Act emained a dead letter on this point. The result was that nstead of one hundred and five district boards having been onstituted in Scotland, only thirty-six, or about one-third ere actually elected ; and small as this proportion was, it as been still further reduced by the lapse of several boards ho had neglected to observe the triennial election precribed by the Act, and the number now stands at twentyve, including Orkney and Shetland, which have recently aken steps to constitute themselves into fishery districts. he Duke of Sutherland is sole proprietor of fifteen rivers Sutherlandshire, and as such has all the powers of a istrict board. These fifteen rivers are, so far as manageent is concerned, apportioned into three districts (included the above twenty-five) under the charge of three factors f the Duke in the capacity of clerks.

There must be reasons for this unsatisfactory and disouraging state of matters, and we shall proceed to indicate few of those apparent. The first thing to which our ttention is directed is the membership of the board, and articularly the appointment of a chairman by the Act. was provided that the Board should consist of three pper proprietors and three lower proprietors (or if less an three of either in the district, of an equal number), an rrangement which seems reasonable and natural so far as gards proportion. But instead of allowing these prorietors to elect their own chairman, according to establshed usage, the Act went on to declare that the largest roprietor in the district was to be also a member of the oard without election, and in virtue of his rental, its chairman, and should have a deliberative as well as a casting vote. When we take into consideration the fact that the whole history of salmon legislation, so far as we have records of it, is simply a recital of the battles and disputes between upper and lower proprietors, born of the deep conviction of the former that their interests were entirely overridden by those of the lower proprietors, it seems strange that the Legislature should not have foreseen the effect of this stipulation with regard to the chairman. As the largest proprietor is naturally *always* a lower proprietor, the effect was to give the lower proprietors a majority of votes at every full meeting of the board. If one of the lower proprietors were absent, they would still have it all their own way, by means of the casting vote of the chairman. This was simply aggravating the grievances under which the upper proprietors had so long groaned, and it is not at all surprising that their cordial co-operation in the new system was not secured. Of course it may be said that the lower proprietors ought to have the majority in votes as they have the majority in value. This may be true as a general principle, but it is not applicable to the circumstances existing between the upper and lower proprietors. If the former had obtained what they believe to be the justice they seek, and the, as it were, personal question had been eliminated, it would have been another matter. It may, however, be asked, "Who is to be the chairman?" If not a lower proprietor, is he to be an upper proprietor? This again would place the power in the hands of the upper proprietors, a result which would not be desirable either. There are two ways of answering the question. 1st. Let the members elect their own chairman *from among themselves*. If they were satisfied to entrust the power voluntarily to one of their own number, whether an upper or a lower proprietor, they might safely be left to do so. Again, the chairman need not necessarily be a permanent one—he may be elected at every meeting, as in the case of the Tweed Commissioners. 2nd. Let the chairman be one who is neither an upper nor a lower proprietor, and who would therefore be entirely unbiassed in the decision of questions which might arise between the two classes. No doubt there are difficulties in the way of this solution, but we feel convinced that it is the only just one, and warrants the attempt to surmount the difficulties. It ought to be as easy to get a chairman as a clerk, or if it is not considered advisable or practicable to attach even a small emolument to the office, recourse might be had to an *ex officio* appointment from among the county justices or other responsible officials in the district.

Another consideration which operated to the discouragement of any united or vigorous action on the part particularly of those proprietors whose interests were not very great, was the provision of § 23 of the Act, that the necessary funds for the due administration of the Act, including salaries of clerks, expenses of watching and prosecutions, &c., were to be raised by an assessment imposed by the Board on the several fisheries in each district. The task imposed on the proprietors was thus neither altogether easy nor always particularly agreeable, while in addition to their personal trouble, they were to find all the funds from their own pockets. It is not to be wondered at if the proprietors in many of the less important districts considered that the end would not repay the means.

The next circumstance which militated against the success of the Act on the subject of District Boards is the provision contained in § 4, that each river in Scotland flowing into the sea, with its estuary and tributaries, should form a district and have a board for itself. It does not seem too much to say that a very little inquiry or consideration would have enabled the framers of the Act to avoid this serious error in the detail of the system of local government. It cannot surely have escaped the promoters, particularly from the publicity which has been given to the fact by the Reports of the River Pollution Commissioners and pollution prosecutions, that many rivers in Scotland have been entirely depopulated. Nor should it have been unknown that many rivers in Scotland, chiefly in the Highlands, are so remote, and run through so thinly-populated and wild districts, while possibly the fishings are not of great value, that the expense of watching them, if efficient watching is not quite impossible, would be so great as to swallow up all the benefit which might be derived from it. In these cases also very large tracts of land are usually in the hands of one or two proprietors, whose residences, or those of their representatives, are so far removed from each other that it is virtually impracticable to have any meetings at all. "Le jeu ne vaut pas la chandelle."

As we shall see further on, the District Boards are too much the creatures of statute, and have not, in some instances, even the powers of common law, with the result that they are of little use, at least in comparison to what was expected of them.

The system of local government thus inaugurated in Scotland was not introduced into England till 1865, but though later it has there been much more successful. The districts are not so numerous as in Scotland, numbering only forty-four, and they are easily and quickly accessible (not more than a twelve hours' journey from London in any case) from any part of the kingdom. The same system exists in Ireland as in England, also with success. The reasons for this difference are to be found in the fact that the districts are all easily workable, while the powers of the Boards of Conservators are sufficiently ample to enable them to deal effectively with the questions arising, and to carry out the spirit as well as the letter of the law, among their powers being the very important one (with regard to England at least) of making bye-laws themselves for the better regulation of the fishings within their districts. Funds, both in England and Ireland, are raised not by assessment on the fisheries as in Scotland, but by licence duties, according to graduated scales, ranging from £1 or less to £30, and thus one item which contributes to the apathy of proprietors in Scotland is removed. Another very important difference in England is that tacksmen of fishings have a right to one seat on the Board of Conservators for every £50 of license duty paid, the effect of which is to secure the co-operation and assistance in carrying out the law of the whole body of fishing tenants in the district.

It must also not be forgotten that both England and Ireland have for twenty-two and twenty years respectively possessed paid inspectors of salmon fishings, the importance of whose office it is impossible to over-rate. They have acted as a central authority to the Boards of Conservators, from whom they receive annual reports of the state of the fishings in the respective districts, and whom they confer with and support in the numerous questions which must always arise. In addition to these Reports from the Conservators, they themselves are charged with the duty of annually visiting all the districts in the country, and ascertaining in person the state of the fishings and the manner in which the law was carried out, as well as of collecting all available statistics which could throw any light on the working of the law, or suggest any improvement in the management of the fisheries, the whole results of their inquiries to be embodied annually in a report to be supplied to the Home Office, and which afterwards, in the form of a Blue Book, becomes accessible to the public generally. It is satisfactory to be at length able to record that Scotland has been placed on the same footing as her sister countries in this respect by the Fishery Board (Scotland) Act of 1882, and the newly-appointed Inspector, Mr. Archibald Young, Advocate, formerly Commissioner of Scotch Salmon Fisheries, than whom a more fitting selection could not have been made, has already given satisfactory evidence of his existence by the promulgation of a series of questions relating to the working of the law of salmon fishing, and who is at this moment engaged on a tour of inspection of the various districts, to obtain answers to these questions, and confer with the district boards on the subject. It is confidently to be hoped that as soon as the beneficial effects of the existence of this official have had time to be felt, the salmon fishings of Scotland will show a rate of progress somewhat more in accordance with that which the statistics of England and Ireland are able to set forth. In England, whose salmon fishings are even now only a third of the value of those in Scotland, inspectors were appointed by the Act of 1861. In 1863 the fishings were valued at £15,000, in 1865 at £30,000, and now (see Report of 1880) they have risen to £100,000 per annum. In Ireland, whose fisheries are now rather more valuable than those of Scotland, though at one time there was good reason to believe that they were much less so, inspectors were appointed in 1863. It is not easy to forgive the government of the day for having been for so long a time so culpably neglectful of the important interests at stake in Scotland. Even now the establishment of the office of Inspector is not on so liberal a scale as in England, notwithstanding the threefold value of the fishings, though nominally one inspector has been recently withdrawn. We should like to see one or two additions made to the powers of the inspector, but remarks as to these may come in more fitly under suggestions for improvement of the law.

ABOLITION OF FIXED ENGINES IN ESTUARIES.

The abolition of "fixed engines" (except cruives) in the estuaries of rivers is undoubtedly one of the most important benefits secured by the Act of 1862. It might have been thought that there was no doubt of the illegality of such engines in estuaries by virtue of the stringent prohibitions in the old Scottish statutes against fixed engines in waters "where the sea ebbs and flows," and of the legal decisions which in several instances have followed on these. They had also been declared illegal by several modern statutes, though not general ones,—in the Tweed Act among others. The stake and bag net fishers, however, took advantage of the fact that it was nowhere laid down what were the limits of the estuaries, and consequently in the absence of any hard and fast definition of what was estuary and what was sea, they put their own interpretation upon the law, and gradually advanced as far as they dared into the estuaries under the pretence that they were still in the sea. There could be but one result of this, viz., that scarcely a fish was allowed to pass up the streams to the spawning grounds, and year by year the evil effect of this became more manifest. The Commissioners under the Act were empowered to fix the limits of all the estuaries with a view of preventing these encroachments, and the fixing of them accordingly drove the invaders out to sea again. Even yet, as we shall see, they are too near. It is unfortunate, however, that the Act omitted to attach penalties to the offence if persisted in, or committed either in the estuaries or the rivers, and consequently the district boards are left powerless to prevent it. The only means of getting at the offenders is by prosecution at the instance of a proprietor, which is obviously inadequate.

Fixed nets are still, however, allowed too near the mouths of rivers, and it is to be regretted that the Act did not go a little further and prohibit all fixed nets within certain distances of the river mouths. This could have been done without affecting the great question of the legality or illegality of these nets on the rest of the shore.

EXTENSION OF CLOSE TIME.

As we have seen, the annual close time had been for four hundred years prior to 1828 fixed at 107 days, while the 1828 Act extended it to 139 days. The Act of 1862 extended the annual close time still further, to 168 days, and the weekly close time from 24 to 36 hours, at which they now remain. Notwithstanding the protests of a few interested parties, there can be little doubt that these amendments were in the right direction, and that the result has largely tended to improve the fishings. There is unfortunately good reason to believe that the full benefit is not obtained which ought to be if the law were conscientiously observed; but it seems impossible to secure this in any single point with regard to salmon fishing. Selfish considerations, or want of public spirit, seem to have full sway, and it is unfortunately too easy to avoid detection in many of the contraventions which are systematically committed. It is more especially difficult to secure the observance by fixed net fishers of the close times, owing first to the difficulty of effective supervision, and secondly to the excuses which they so readily bring forward on the score of stress of weather, &c.

POACHING AND POLLUTIONS.

We have seen that the 1862 Act entirely omitted the great question of fixed engines, owing to the pressure brought to bear by the lower proprietors. It also left untouched another crying evil, that of poaching, though apparently for no other reason than that this offence was, to some extent at least, already regulated partly by Home Drummond's Act, and by the general Poaching Act of 7 & 8 Vict. c. 95. Even if it had been sufficiently regulated by these Acts, which we submit it is not, the omission is part and parcel of the objectionable policy of leaving the whole law on the subject to be gathered from a large number of different sources, which has long prevailed in Scotch salmon fishery legislation, notwithstanding the better example of our neighbours, and which has resulted in the accumulation of a mass of Acts and isolated enactments of more or less ancient date, the ultimate effect being to create a totally unnecessary difficulty in ascertaining the exact state of the law, and a confusion and uncertainty in the mind of the investigator as to whether certain Acts are still in force or not. The provisions made with regard to pollutions have proved of little or no use to prevent, or even materially to check, the evil, which has rapidly assumed such gigantic proportions as to threaten, by its own unaided efforts, to remove all need for salmon legislation at all, by dismissing the genus *Salmo* to the company of the archæopteryx, the dodo, and other extinct animals. It seems strange that the Legislature did not recognise the fact which district boards very soon found out, that the powers entrusted to them as a body were actually less than they already possessed in their individual capacity as riparian owners. Consequently, although prosecutions by district boards would have been a far more suitable and effectual method of stopping or checking the offence, they have become quite unknown, and the polluters have naturally in many instances grown more bold, and become less and less careful to avoid discharging their deleterious matters into the rivers, and less solicitous to adopt means of purifying the water while in their possession.

MISCELLANEOUS.

There are a few unimportant points on which the Act is deficient, which we may perhaps touch upon afterwards. The Act as it stands contains also some deficiencies of a minor degree which have been duly corrected or set right by the subsequent Act of 1868—*e.g.*, the use of a leister for spearing salmon was not prohibited in the daytime; the articles and appliances used by night poachers, and the fish caught by them could not be seized and forfeited; repeated offences were not, according to the usual practice, punished by an increase of penalties, graduated or otherwise, except with regard to pollutions; foul or unseasonable fish could not be seized and forfeited; and the cumulative penalty of £2 for each fish taken could only be imposed if it could be proved that the fish were taken by the person or persons accused, as well as in his or their ion.

SALMON FISHERIES (SCOTLAND) CONTINUANCE ACT, 1863.

By the Act of 1862, the duration of office of the Commissioners under it was limited to three years (a limit afterwards withdrawn), but the bye-laws which they were empowered to make were to be framed and reported to the Secretary of State by the 1st day of January, 1864. As this time was found to be insufficient, it became necessary to extend it, which was done for one year by this Act, which also gave power to the Commissioners by means of a bye-law to extend the limits of the mouth of the Tweed.

SALMON FISHERIES (SCOTLAND) AMENDMENT ACT, 1864.

The time for making the bye-laws having proved still too short, it was extended to 1st January, 1866, by this Act, which also made certain provisions as to the making or re-issue of bye-laws in cases where district boards had not been formed.

SALMON EXPORTATION ACT, 1863.

This Act (which is next in point of time to the Act of 1862) was passed to prohibit the exportation of salmon caught in the United Kingdom during the close time. The sale of such salmon had previously been illegal, but it was found that the law was being evaded by the sale in foreign countries of fish which could not lawfully be sold at home.

ACT OF 1868.

We now come to the companion Act to that of 1862 in the regulation of the Scottish salmon fisheries. The length of this Act (forty-three sections) might at first sight lead us to suppose it of greater importance than it turns out on examination really to possess. There is nothing actually new in the Act, and indeed it might very well be described as a revised edition of the Act of 1862, though it is perhaps not quite so comprehensive. Many of the sections in the latter Act are simply re-enacted with slight alterations in the wording, &c., so as to remove possible doubts as to the extent of their application. There are several provisions as to the constitution and proceedings of district boards, and they are empowered to petition the Secretary of State to make alterations as to the close times (excepting as to their length), and as to cruives. The hands of the district boards, and of the officials employed by them, are somewhat strengthened with regard to offences. The omissions already alluded to are supplied. It is also enacted that all nets and implements used in fishing shall, within thirty-six hours after the commencement of the annual close time, be removed and secured, so as to prevent their being used in fishing till the end of the close time, with the exception of boats for angling, and that all cruives shall be so dismantled and secured within the same time as to prevent their being used in fishing till the expiry of the close time. The reason for this rule is to be found in the fact already alluded to, that the proprietors or occupiers of these fixed engines, particularly the nets, had been in the habit of entirely ignoring the law as long as they could do so without being found out. For them the close time only commenced when they were forced by the authorities to give up catching fish, and if the nets and cruives had been allowed to remain *in situ* during close time, in all probability they would have been used as before on every occasion, when the back of the officials was turned, which owing to the natural obstacles in the way, must necessarily have been pretty often. Even now it is difficult to secure the removal of the nets, &c., at the proper time if there is not a constable or watcher looking on, while of course the observance of the weekly close time is a matter of greater difficulty still. While on this subject we may point out an inconsistency between sections 15 and 24 of the Act of 1868. The former section imposes a maximum penalty of £5 for every breach of the annual or weekly close time, and a further maximum penalty of £2 for every salmon taken or killed in an illegal manner, together with optional forfeiture of nets, boats, rods, &c. (section 31). Section 24 again enacts that every omission to do any act required for the due observance of the weekly close time shall incur the following penalties, viz.: (1) forfeiture of net or nets used; (2) a maximum penalty of £10 for each net in respect of which such omission occurs, and a further sum not exceeding £2 for every fish taken or killed by means of such nets during the weekly close time. Section 15 seems directed against any *positive* infraction of the law, while section 24 seems intended to punish *negative* infringements in regard to the arrangement of the nets, &c., but it is difficult to draw a distinction in effect between the two sections. We are not aware that the point has ever actually come up for decision, though it has been commented on, but there seems no reason to doubt that the penalties in both sections could be inflicted for a single contravention of the weekly close time, by means of nets at least. It is not probable that this was intended. Again, the principal penalty under the latter section for breach of *weekly* close time is double that imposed by the former section for breach of the *annual* close time. There is, however, in the latter case the penalty provided by the 23rd section of the Act, of £10 for each day during which any article used in fishing shall remain unremoved after thirty-six hours from the commencement of the annual close time, with forfeiture of nets, &c. There is no supplementary penalty under this section, of £2 for every fish caught. The anomaly contained in these sections has already somewhat interfered with the due administration of the Act, and it would be very desirable to have the matter put on a clear and intelligible footing as soon as possible.

SPECIAL COMMISSIONERS' REPORT OF 1871.

The state of the law under these two Acts (1862 and 1868) was not found to be at all satisfactory, and continual agitation was made for its improvement. In deference to this agitation, the Government appointed in 1870 a Commission, consisting of Mr. Frank Buckland, one of the English Inspectors of Salmon Fisheries, and Mr. Archibald Young, one of the Commissioners of Scotch Salmon Fishings (now permanent Inspector), to inquire into, and report upon, the effect of the Acts. These Commissioners made a most complete and exhaustive inquiry, and collected a large mass of valuable evidence bearing upon the subject and upon all the questions laid before them by the Home Office. They issued their Report in 1871, embodying the results of their inquiry, and making a large number of suggestions for improvement of the law, supported in most cases by the weight of opinion of the parties most concerned and most entitled to speak. The testimony of the different witnesses, as given in the appendix, is, however, often very conflicting, and personal interest is sometimes very apparent; but doubtless the Commissioners, in coming to the conclusions which they laid before the

Secretary of State, did not overlook the principle, "Sententiæ ponderantur, non numerantur." The labour and skill displayed in digesting and arranging the mass of opinions and dicta of all sorts cannot fail to secure the admiration of any one who consults the Report.

This Report, even at this distance of time, still remains the most recent official paper relating to the general questions connected with the Scotch salmon fisheries, and it must necessarily form an indispensable and valuable source of reference and consultation in the framing of any new measure dealing with the subject.

FISHERY BOARD ACT OF 1882.

It now only remains to notice the Fishery Board (Scotland) Act of 1882, which contains a few sections relating to salmon fishings. Though few, these sections are very important. Section 2 provides that the Fishery Board established by the Act shall have the general superintendence of the salmon fisheries of Scotland, and shall have the powers and duties of Commissioners under the Salmon Fishery Acts, but without prejudice to, or interference with, the powers of district boards. The Board is to render an annual report to the Home Office, containing all statistics relating to the fisheries, with suggestions for their regulation and improvement. This Report will be presented to Parliament, and issued to the public in the same manner as the English Salmon Fishery Inspector's Reports.

The most important provision in the Act, however, is that empowering the Secretary of State to appoint an Inspector of Scotch Salmon Fisheries, who will have duties and powers analogous to those of the English and Irish inspectors, but whose annual report will be presented to the Fishery Board, instead of direct to the Home Secretary. In terms of this provision, Mr. Archibald Young has been appointed inspector. Every one who has taken any notice of the progress of salmon legislation during the last fifteen or twenty years must feel that Mr. Young is the right man in the right place. The Government must, however, support the inspector and the Fishery Board in any recommendations they may make, if the full benefit is to be derived from the system. We are far from resting satisfied with what has been done, though it is a great step gained; nor do we forget that the appointment of an inspector is only a concession to Scotland of a clamant right, which it is no credit to the different Governments that she should have been deprived of so long, seeing that her sister countries, and particularly England, whose fisheries are so much less valuable, have possessed the boon for twenty years.

SUPERINTENDENCE OF SALMON FISHERIES BY FISHERY BOARD.

With regard to the appointment of the Fishery Board to superintend the salmon fisheries, we will venture to make a few observations, as we are not convinced that this arrangement is the best that could be made. In the first place the Fishery Board has quite enough to do with the supervision of the enormous industry into which the herring and other sea fisheries have developed. These fisheries, with all their cognate questions, are a special study of themselves, and are, besides, at present in a state requiring much and earnest attention. Then, from the other point of view, we think that the salmon fisheries would have much more chance of receiving their full share of attention if they had a board to themselves. Although the value of the salmon fisheries is very small compared with the white fisheries, the subject is a complicated and difficult one to manage, embracing as it does the conflict of so many interests, both public and private, and so many burning questions of all descriptions. Besides, the very fact that the value of the salmon fishings is so small, in comparison with the herring fisheries (about £300,000 to £2,250,000 per annum), predisposes one to imagine that the former must occupy a subordinate position by immediate contrast with the latter. There would not be the same probability of their being overshadowed by the larger industry if they were in a separate department, or sub-department, or simply under the charge of the inspector, with responsibility direct to the Home Secretary, as in the case of England. If this plan were adopted, the supervision of trout fishing might be added to that of salmon fishing, as it is every day becoming more evident that something must be done for the preservation of trout.

SUGGESTIONS FOR IMPROVEMENT OF LAW.

We shall now proceed more systematically to offer a few suggestions for the improvement of the law of salmon fishing in Scotland, though, as the subject has been an open one for so long, and has been so fully discussed by various authorities, we cannot claim entire originality in many of them. As it always is good policy, however, when agitating for reforms, to keep the views of the reformers before the eyes of the "powers that be," we trust some purpose may be served by the present paper.

CONSOLIDATION ACT.

The difficulty of administering the law on our subject is enormously increased by the effect of the slipshod system which has been recently pursued in the enactment of it. Instead of repealing all former Acts relating to the subject, after having collected all the portions of them which it was desirable to adopt, and inserting them in the new Act, so as to make an entirely new departure for salmon fishing legislation, the framers of the Act of 1862 contented themselves with simply making it an amendment of the Acts previously in force, whatever these are. That this was their deliberate intention is apparent from the preamble of the Act. The result is that there is still in force a large number of old Acts, or portions of Acts, which are more or less inapplicable to the circumstances of the present day, and a state of confusion and uncertainty is produced in the minds of all concerned as to what is really the law on many points. The legal maxim, "Ignorantia juris neminem excusat," which is usually strictly applied, ought to be suspended or reversed in this case, until matters are put upon a more satisfactory footing.

One would have thought that when, in a period of 157 years, there had only been one statute passed on the subject, and that one 34 years old, the necessity of an entirely new departure would have been the first thing to strike the Government. There is the less excuse for the error when we remember that the English Act, which had been passed immediately before, repealed all prior statutes. The first thing, therefore, now to be done is to pass a Consolidation Act, complete in itself, and wiping out of the statute book all previous legislation relating to salmon fisheries in Scotland, including the Acts of 1862 and 1868.

POWERS OF INSPECTOR.

It does not appear that the powers granted to the Inspector of Scotch Salmon Fisheries by the Fishery Board Act are very ample, or co-extensive with those possessed by the English and Irish inspectors. The Secretary of State is to appoint an inspector, who, under the direction of the Board, shall inspect the salmon fisheries, inquire into the operation of the Salmon Fishery Acts, and report thereon from time to time. The inspector is a responsible and able official, and a great deal more might be entrusted to his discretion than the Government have thought fit to do by this Act. He might advantageously be made an intermediate authority between the Local Boards and the Fishery Board, with power to advise and direct the former in any cases of difficulty which might arise, and he should have power to act as a District Board in all cases where no District Board has been constituted or now exists. He is required by the Act to report on the fisheries, and the operation of the Acts, from time to time, which, it is presumed, will be yearly; but it does not appear that he has any power to require the District Boards to render annual reports to him with regard to their districts. Possibly he may be able to attain this result without express powers, but it would be more satisfactory if he had these. The English Boards of Conservators send in annual reports, containing all available statistics with regard to their districts, with suggestions and remarks thereon, and the value of these cannot well be over-estimated. The inspector should also have power himself to make bye-laws for the protection of the fisheries, and their regulation and development, a power which the Boards of Conservators in England have possessed since 1873. In important cases, right of appeal to the Fishery Board or the Home Secretary might be reserved if it should be thought necessary. The inspector should be permitted to exercise his discretion, within, perhaps, certain limits, as to the duration of the annual and weekly close times, as well as the dates at which they are to commence and end. As we have seen, the Act of 1862 rigidly fixes the annual close time at 168 days and 36 hours respectively. In England the Home Secretary has power to extend or vary the annual close time, though it is nominally fixed by statute at 154 days. In Ireland the inspectors are only limited to a *minimum* of 168 days.

The compulsory removal of obstructions is another matter which might be handed over to the inspector with advantage, as he would not have the same difficulty in strictly enforcing the law as the District Boards may have, owing to local influences.

We confess we are unable to see the great advantage to be derived from appealing to the Secretary of State on matters such as these, with which, even with the assistance available to him, he is probably not so conversant as those who have to refer to him, or whose opinions he is required to review. On the contrary, the system is often the cause of great delay in instituting important improvements, owing to the necessity of waiting for his confirmation of any proposal. Appeal to the Home Secretary should not therefore be competent, except in cases where important private interests were involved, and even these, if too important for the inspector, might with greater advantage be left to the arbitrament of the sheriff of the county concerned.

FIXED ENGINES.

Among the causes contributing to the decline or stagnation of the salmon fisheries, the use of "fixed engines" occupies a prominent place, though of course this is denied by the proprietors of these engines.

It did not take long to discover that if the use of fixed nets and traps in rivers were not subjected to some restriction, there would not be a single salmon left to catch, and once this was realized, our ancient legislators did not dally with the question, but promptly, and in no uncertain tone, forbade the practice under severe penalties. This prohibition extended both to rivers and estuaries, and it has been confirmed by modern judicial decision, as well as by statute. There still exists, however, a limited number of cruives and yairs, erected by virtue of special grant from the Crown, and which cannot therefore be abolished without compensation.

Though fixed nets were thus driven out of the rivers and estuaries, they were not to be so easily got rid of. By-and-bye it was found out that salmon, when going to or from the rivers, "hugged the shore," and nets which would stand in the sea were at once devised to intercept them. The first of these nets was erected rather more than sixty years ago, and was speedily followed by thousands of them on every accessible or likely portion of the coast, quite irrespective, in many cases, of right to fish for salmon. This selfish policy, however, to some extent overreached itself, as there was not room for all the nets that had been erected, and a good many were finally given up, because they could not be worked with profit. They are still very numerous, however, and as the preponderance both of evidence and authority seems to show conclusively that they are injurious to the real interests of salmon fishery, they should be either altogether abolished or subjected to much more severe regulation than is at present applicable to them. The latter policy has been adopted in Ireland with regard to those few fixed nets which were allowed to remain. The following considerations are urged on behalf of the fixed nets by the proprietors or others interested: (1) that they are established by prescription, and cannot therefore be abolished without compensation; (2) that to abolish them would seriously affect the food supply of the country from this source; (3) that though they may diminish the number of fish which reach the rivers, they cause no decline in the total number of fish caught annually, and further that the fish which they catch are in better condition than those in the rivers; and (4) that no other method of fishing with profit is available in the sea. The first of these pleas is a very plausible one, and presents no little difficulty. Prescription, however, cannot run against statute; and though fixed nets on the shore are not specifically mentioned in the old statutes, we ought to hold them included, because the spirit of the whole legislation is so clearly and forcibly directed against fishing by means of fixed nets in the "run of the fish," as being unfair and destructive, that we cannot for a moment doubt that the prohibitions would have been extended to the sea, had fixed nets been in existence there at the time, or their existence been foreseen. We must not forget the rule that remedial statutes are to receive a liberal interpretation. These old Acts prohibit all fixed engines in the "run of the fish." The natural history and habits of the salmon were not then as well known as they are now, and the legislators were totally ignorant of the fact that the seashore is as much the "run of fish" as the river. That no such mode of fishing was ever authorised or contemplated is clearly shown by the terms of the charters, in no single one of which is anything to be found to give colour to the claim, and the proprietors of fixed nets have simply erected them without any right to do so, and on chance of their being permitted to remain. It was in the rivers that salmon fishery was originally recognised as property, long before even a coast charter was granted (in 1603), and no persons could have at any subsequent time a right to encroach on this private property, directly or indirectly. That is precisely what the fixed net fishers on the coast have done, however, with the result that what was once a valuable possession has in many cases become useless, and no compensation has been paid to those deprived of a considerable portion of their income, in securing which often a large amount of capital had been sunk. It is difficult to see what better claims to compensation those persons would have for the abolition of a practice which was really illegal at first, and which has only acquired a semblance of right because, owing to the uncertainty of the law and the want of proper opposition, it has been allowed to exist beyond the prescriptive period. The appropriation of the waters of rivers and streams by manufacturers without any title, and totally oblivious of the rights of others, is a case on all fours with that under discussion. Their so doing has destroyed in many cases the fishings formerly enjoyed and paid for by riparian proprietors, and depreciated in all cases the value of the land through which the streams passed; but for want of proper opposition, combined with a mistaken notion on the part of the authorities that it would not do to interfere with industry, the illegal encroachments were allowed to go on till they have obtained a hold which it is difficult now to shake off. The dispossessed proprietors got no compensation in this instance. No doubt many of the present proprietors of coast fisheries have paid large sums for their fishings, in the belief that they were legal, and it might seem an injustice to visit on them the sin of their predecessors. We do not, however, argue that it would be right in *all* cases to abolish fixed nets without some compensation. Means could be taken to ascertain the exact circumstances connected with the exercise of that right in every instance, and any case developing exceptional circumstances might be exceptionally dealt with. This, however, in no way affects the public question of the legality or illegality of the fixed nets, and if that question were decided against the legality, there can be no doubt that there would be no right to compensation. There is a strong preponderance of evidence and presumption that these nets were unlawfully erected at first against the spirit, if not the letter of the statute, and that therefore prescription should not be held to legalise them. Besides, prescription properly only applies to private rights, and has never been, and is not now, admitted where it is "hurtful to the common weill."

It is a well-known fact that as a rule proprietors and tacksmen of these coast fisheries are particularly careful to prevent reliable statistics getting into the hands of the public. It is only a fair inference to make from this course of action that they are more or less conscious that the fixed nets are not established on too sound a footing, and are destructive to the fisheries. If they were not destructive, the surest way to prove it would be by the collection and publication of the fullest statistics of the different fisheries, and the giving of every facility to the authorities in their inquiries. In connection with this view, it is interesting to notice the reception which the recently-appointed Government inspector met with at the hands of some of the lower proprietors and tacksmen on the east coast, in his endeavour to obtain information from them, and the two meetings of lower and upper proprietors shortly thereafter held in Edinburgh. Mr. Young, before starting on his tour of inspection of the whole salmon fisheries of Scotland, on which he is at present engaged, sent a list of queries to the various districts. Certain proprietors or others, in one county at any rate, met and resolved to afford no information to the inspector, and when he afterwards met them, they even went so far as to put questions to him, which he of course declined to answer. It is thus evident that these parties are afraid of legislation, and that this fear is general among lower proprietors is amply confirmed by the proceedings at the meeting of lower proprietors referred to, at which the language was neither conspicuous for moderation nor fairness, and formed somewhat of a contrast to the tone prevailing at the subsequent meeting of upper proprietors, which was called in consequence of the action of the lower proprietors. The second resolution of the latter meeting runs as follows:—"It is believed that as salmon are decreasing in numbers by over-netting, all proprietors of fishings would be benefited in many ways by legislation, and that the interests of the upper, as well as of the lower proprietors, ought to be fully considered in any future legislation." This is the only reasonable and just view to take of the matter, and the opposition of the lower proprietors is a very shortsighted policy. It is surely better to exercise a little forbearance in the present, though at the risk of slightly diminished profits for a time, than to fish in such a manner as sooner or later to depopulate the waters altogether, so far as salmon are concerned. "You can't both eat your cake and have it," as the proverb goes.

The argument that the abolition of fixed nets would seriously reduce the food supply of the country, supported as it is by the high and unbiassed authority of the Special Commissioners of 1871,* is of course entitled to greater consideration. But there is nevertheless a good deal of evidence on the other side, and it is backed up in many cases by actual proof. Mr. Alexander Jopp, of Aberdeen, published in 1860 a pamphlet, giving, with some useful information as to the fishings generally, a large quantity of valuable statistics relating to the Aberdeenshire fishings, bearing upon this point. It is there shown conclusively that salmon had greatly decreased, both in number and weight, since the introduction of stake-nets, though his results referred more particularly to the rivers, and not to the sea. The number of boxes of salmon annually exported gives some indication to the same effect; but stronger evidence still is obtained in the fact that several proprietors of fixed nets on the coast very largely increased the rentals of their whole fisheries by giving up the fixed nets. The Duke of Richmond, for example, increased his rental from £6,000 to £13,000 in eight years, by removing the fixtures at the mouth of the Spey, and the Duke of Sutherland and the Earl of Fife, and also Lord Lonsdale in the Solway, all likewise materially increased their fishing revenues by following the same policy. More evidence, leading to the same result, could be adduced. The case of the Tweed is also very conclusive of the same view. Not only, therefore, do fixed engines diminish the number of fish which reach the rivers, but they diminish the total annual number of fish caught. The evidence of many proprietors, some of whom are both upper and lower, is easily obtainable to prove the decrease in their fishings, both of fish and rental.

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* See Report, p. xiv.

It cannot be denied that fish taken in the sea are in better condition for food than those caught in fresh water, but is that a sufficient reason for persisting in a mode of fishing which is slowly but surely leading to extermination? The mere recollection of the superiority of sea-caught to river-caught fish will not satisfy us. Besides, it is not necessary to give up sea-caught fish. There are other ways of taking them than by fixed nets, though no doubt there are some places on the coast where no other mode of fishing is properly available, but this was the case before the introduction of fixed nets, and is so, besides, in many rivers. Yet no compensation was given to river proprietors for the abolition of fixed nets.

The assertion that no other mode of fishing can be followed with profit is subject to qualification. "With *so much* profit" should be substituted, seeing that the capital is intrenched upon to a greater or less degree.

Besides, from the point of view of the public interest, these stake and bag nets are objectionable on account of the expense involved in working them, which considerably increases the price of the fish to the buyers. Net and coble fishing costs very much less.

Many exhaustive inquiries have been instituted by Parliament on the subject of fixed nets, and the almost invariable result has been that Commissioners and Committees, even those appointed in the interest and on the instigation of the fixed net proprietors, have recommended the entire suppression of this mode of fishing, and it has been suppressed accordingly in England, while all fixed nets erected after 1862 in Ireland are illegal, and those allowed to remain are subjected to stringent regulation.

But if it should be deemed inadvisable to put down fixed engines altogether, at least they can, and ought, to be placed under the closest restrictions, and adequate measures should be taken to ensure that those restrictions were scrupulously observed. If the erection of any more fixed nets after the present time were prohibited, pending the decision of the legality or illegality of those now existing, at least a step would be gained. With a view to the framing of regulations, the suggestions contained in the above-mentioned Report of 1871 seem very suitable, and should be adopted.* The distance from the mouths of rivers might, however, be extended in most cases to from one to three miles, according to the configuration of the coast. Stake-nets should in no case be permitted to extend further than from high to low-water mark; bag-nets should be restricted to steep rocky coasts, and not allowed nearer than three miles from the mouth of any river. Bag-nets, also, should not be allowed to be joined to stake-nets. These are the rules in force in Ireland, and they are believed to work satisfactorily.

Severe penalties should be attached to contravention of the close times, as there is reason to believe that the law is often ignored at present, particularly in remote or thinly populated districts, and if any complaint is made, excuse is offered on account of stress of weather, absence of employers, &c. It has been suggested that in any case where stress of weather prevents the due observance of the weekly close time, the proprietor or tacksman of the nets should be bound under a penalty to report the matter to the chief constable of the county, or other official, and satisfy him that the nets were closed for fishing for an equal period when the weather allowed it; also that the close time should be by tides and not by hours, as is the case in the Tweed.

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* See Report, p. xiv.

With regard to the possibility of reducing the number of fixed engines now in operation on the coast, the Crown has in its hands the means of materially contributing to this effect, and at the same time showing a good example. We refer to the ownership by the Crown of all the fishings on the seashore which have not been granted, and these must be very numerous. If the Crown would abolish fixed nets in its own waters, means might be found to induce other proprietors to follow the example. (1.) If the Crown were to carry to its legitimate issue the inquiry set on foot in 1859, as to the titles of all persons exercising salmon fishing on the seashore, a large number of persons now fishing would be turned off. (2.) Every proprietor whose title had been examined and found satisfactory should be entered on a register (a copy of which should be supplied to District Boards), and a certificate to that effect should be granted him by the Commissioners of Woods and Forests, which he should be bound to exhibit at all times when asked by proper authority, care being taken, of course, to provide that this was only a certificate of title to salmon fishings, and not of legality of any mode of fishing. (3.) After a reasonable interval to allow proprietors to send in their titles for examination, it should be declared that all persons not in the list and not provided with certificates of title, should be liable to prosecution and penalties for illegal fishing, which should be rigorously enforced. Any proprietor producing a good title after prosecution had been instituted against him, to be liable in all expenses.

(4.) In all the fishings which would thus lapse to the Crown, and all those presently in its possession, let or unlet, the Crown might be expected to forego making profit at the expense of the public good, and prohibit the use of fixed nets to all its lessees. If these suggestions were carried out, the number of fixed nets would be greatly reduced, and it would then become much easier to make regulations regarding the nets on a certain expanse of shore, distance from river, &c., while at the same time taking care to avoid doing anything to legalise them.

POLLUTIONS.

It is surely no longer possible to deny that effectual legislation is most urgently required to check the great and crying evil of pollution of rivers, and the Government which delays taking speedy steps for this end assumes a grave responsibility.

Acts have been passed with regard to preservation of fish, removal of nuisances, and river pollution generally, but they have all proved useless. Statute and common law alike are well nigh a dead letter, and the evil is increasing day by day. The longer, too, it is allowed to go on without being effectually checked, the worse it will be to put down when the attempt is actually and earnestly made. There is scarcely a river in Scotland which is not made a common sewer of, to a greater or less extent; and, in addition to killing all the fish and making the water totally unfit for primary purposes, some rivers absolutely stink, as any one may ascertain for himself in the neighbourhood of any large manufacturing town situated on a river. The Legislature has been too tender of the feelings of manufacturers, and too fearful of interfering with the industries of the country, or things would never have been allowed to come to the pass they have. The health of the community ought to be the first consideration, not to speak of fish life at all, and we do not see how it will ever be possible to stamp out those zymotic diseases which are the scourge of the country, until pollution of rivers is put down with a strong hand. There are several cases of poisoning and one of death on record, as caused by these pollutions in the Tweed, and we are satisfied many more could be authenticated.

The question is a great one, no doubt, but it is perfectly possible to handle it. It has been shown over and over again, both by the River Pollution Commission and other authorities, that there are plenty of means whereby the noxious matters may be artificially destroyed or removed in the manufactories or in sewage works, so that the liquid which is allowed to flow into the river is rendered entirely harmless. In some paper mills where esparto is largely used, evaporators were at one time introduced, which served the purpose efficiently, but because it was found that they simply paid the cost of working, and left no profit, they were given up. This, and many shameful evasions of the law by making hidden outlets in the river for their abominations, show how much some (for, fortunately, there are honourable exceptions) manufacturers care for anything beyond their own pockets. They will do nothing till they are forced to do it. It is not expected that profit can be made out of those methods of purification, but manufacturers ought to be very thankful if they can destroy or use up the noxious matters on their own premises without any cost to themselves. Let it cost them what it may (and, at the worst, it is only reducing their large profits to a small extent), there ought not to be a shadow of doubt that they should be compelled to abstain from polluting any stream so as to deteriorate it even slightly for primary purposes, or render it injurious to fish life, and transgression of the law should be visited with penalties so rigorous as to make it their interest to avoid incurring them.

The cost of purifying sewage must, of course, be borne as a tax by the inhabitants of the town or district concerned. In connection with this branch of the question, there is an interesting paper printed in the Appendix to the First Report of the Scottish Fisheries Improvement Association, giving an account of the sewage purification works at Hawick, from which it appears that the sewage both from the town and the mills is so treated that the liquid entering the river is perfectly innocuous to fish life when mixed with nine-tenths of river water to one-tenth of sewage, and the engineers state that the outflow from the purification works during the day is about one-twentieth of the minimum flow of the river, or one-fortieth of the average summer flow, leaving floods out of account. The cost to the ratepayers is from 4*d.* to 5*d.* per £. When one town can attain these results, there is no reason why all should not do so. The same Report contains a short account by the late Sir Robert Christison, of a method by which paper or other manufacturers, instead of using and polluting the large quantities of water which they do at present, could effect their purposes quite as well by using very small quantities, so that evaporation would be rendered easy, and the residuum could be burnt up with the waste heat of the works.

The latest scientific testimony to the practicability of purifying the discharges from mills and manufactories so as to render them comparatively innocuous, is to be found in a Report by Professor Crum Brown, of Edinburgh

University (which was published in the newspapers), in compliance with a remit to him by the Court of Session in the action by the riparian proprietors on the Tweed against the Galashiels manufacturers. A method of treating the polluted discharges is therein pointed out, which Professor Crum-Brown states would so purify them as to render them harmless, and the cost of which would not be too great if shared by all. But there is no lack of methods [*] if the manufacturers will only adopt them, and if they will not do so spontaneously, then the law must step in. Of course, this question is of too much importance to the community at large to be entirely disposed of in a Salmon Act. There must be an Act solely dealing with the whole subject of pollution in all its bearings, and that in no half-hearted manner. But, notwithstanding the urgency of the situation, it may take a long time to carry such a measure, because the influence and opposition of a large number of manufacturers, which smothered the Lord Advocate's Pollution Bill of 1864, and have stood in the way, more or less effectually, of all legislation on the subject, may be expected to step in again and at least delay the issue. Therefore, any new Salmon Act should contain stringent pollution clauses, and give powers to district boards and inspector to deal with the matter in a way that will be effectual. Very heavy penalties should be enacted, and where there is good ground for suspicion, as shown by samples of water, dead fish, or absence of life generally, the onus should be laid on the manufacturers to prove that the water was not polluted to an extent injurious to fish life, or rendered unfit for primary purposes, and if the offence is repeated, in addition to increased penalties, power should be given to cut off the water supply altogether. For persistent repetition of offences the penalties might even be allowed to culminate in a power of imprisonment, if nothing else would do. The sewage of towns might be dealt with by ordering every town to construct sufficient purification works within a certain limited period, under penalties to be laid on the individual members of the Corporation for failure to do so.

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[*] See Report of Rivers Pollution Commissioners, p. 13.

In a new Salmon Act, of course, it will not be forgotten to correct the careless error made in the 16th section of the Act of 1868, which, while taking out of the 13th section of the Act of 1862 a re-enacted provision as to pollution by sawdust, leaves half of the clause which belonged to it, with the result of making it necessary to prove that poisonous matters are discharged into a river "to an extent injurious to any salmon fishery," a reading which is evidently absurd, but which has nevertheless done great harm.

MILL-DAMS, &C.

Manufacturers are largely responsible for yet another serious interference with salmon interests, but fortunately there is reason to hope that this may soon be brought within satisfactory limits. We refer to obstructions in the bed of streams for milling and manufacturing purposes, which prevent the fish from getting up to the spawning grounds.

Before the Act of 1862, the construction of dam dykes was regulated by the Act, 1696, c. 33, which provided that there should be a constant "slop" in the midstream of each mill-dam dyke, as wide as convenient, without prejudicing the going of the mill, and prohibited all fishing at those dykes. The 1862 Act gave power to the Commissioners "to make general regulations with respect to the construction and alteration of mill-dams or lades, or water-wheels, so as to afford a reasonable means for the passage of salmon," which they did accordingly by Bye-law G. annexed to the Act. With regard to this bye-law, Mr. Stewart, in his 'Treatise on the Laws of Scotland relating to Rights of Fishing,' says: "It will be observed that the Commissioners' bye-law leaves existing mill-dams, &c., as they are, and, however destructive they may be to the passage of the fish, no alteration in them is required, until a reconstruction is undertaken by the proprietor; then, and then only, must the regulations of the bye-law be given effect to." This does not seem exactly correct. It is only the first paragraph of the bye-law, relating to the making of dams watertight, that refers to new dams or dams requiring to be renewed or repaired. It does not appear that there is any authority for applying this restriction to any other paragraph in the bye-law, in which the expression used is always "every dam," "every mill lade," &c., &c. This difference is particularly of consequence with regard to salmon passes or ladders, which are to be "on the down-stream face of every dam, weir or cauld." This distinctly includes every dam, &c., whether new or old. The district boards have, therefore, full power to insist on salmon passes being placed in every dam or weir in any salmon river in the country, but, if there is any doubt on the point, it should be removed in any new Act. There are still, however, many dams in existence with no passes at all, others where the pass made is quite insufficient, and others, still, where the pass makes a greater obstruction than existed before, although this is in express contravention of the last paragraph of the bye-law, and in all such cases the powers of district boards should be put into use, and would, no doubt, prove sufficient. though they should, in addition to statutory powers, have the common law powers of riparian proprietors to put down obstructions. But there is still room for improvement in the regulations as to artificial obstructions, and many valuable suggestions have been made. The Commissioners allow a gradient of 1 in 5, which experience has shown is too steep. It should never be greater than 1 in 9 or 1 in 8. It seems worth consideration whether, in cases where an easy gradient is difficult or impossible to obtain, it might not be advisable to make a hole in the weir, to act as a pass. This plan has been approved by a good many experienced persons, though some think it would not do. It has been considered quite feasible, however, with regard to natural obstructions, as will be seen from the Special Commissioners' Report of 1871. The dimensions, &c., of the hecks in mill-lades fixed by the Commissioners in their bye-law, have been proved to be insufficient, especially to prevent smolts getting into the intake lade, and eye-witnesses have stated that they have seen the bottom of some lades absolutely whitened by the dead bodies of unfortunate smolts killed and mutilated in all sorts of ways by the mill wheel. Smolt proof guards should be placed on every intake lade, and the tail race should also be protected against ascending fish. As Mr. Young points out, there is a clause relating to gaps in fishing weirs (which were not affected by the Commissioners' bye-laws) in the Irish Act of 1863 (section 9), which might advantageously be adopted in a Scotch Act. All dams and weirs, whether old or new, industrial or fishing, should be made watertight; and it should be compulsory to shut the sluices of intake lades on Sundays, or when the mills are not working. At present, much water is wasted because this precaution is not taken. Cruive dykes should also be made watertight, as was intended by the Commissioners, had the bye-law not been altered by the

Home Secretary. Any obstruction of fish passes, whether for the purpose of preventing fish passing or not, should be added to the offences in section 15 of 1868, as it is not uncommon for rod-fishers to stand on the steps of ladders in order to get a convenient spot for a cast, and so prevent fish getting up.

NATURAL OBSTRUCTIONS.

There are a good many natural obstructions in the Scotch rivers, which shut up large tracts of spawning ground, but, situated as these are in most cases on private property, legislation cannot interfere with them. The Scotch Commissioners have, however, ascertained that in the most important cases passes can be managed, and most of the proprietors are likely to give their consents. While it might be too extreme a step to give power of compulsory removal of these obstructions unless there was clearly no destruction of amenity, compulsory power might certainly be granted to attach fish passes to all those where it was practicable. If any questions should arise such as are indicated in the Commissioners' Report of 1871, they might be settled by the Crown giving a right of salmon fishing to the upper proprietor.

What may be accomplished even as a speculation by the judicious construction of ladders over otherwise insurmountable falls, is most instructively shown in the case of the famous Ballisodare fisheries in Ireland. Before 1856 the Ballisodare river was salmonless. Mr. Cooper, the proprietor, did not see why it should remain so, and, after clearing his way by purchasing all rights which might interfere with him, and obtaining an Act of Parliament creating a several fishery, he constructed the celebrated ladders. The whole cost, including Act of Parliament, purchase of conflicting rights, litigation, &c., was less than £7,000, the ladders themselves costing less than £1,000 of that sum. The result is, that the investment yields from 200 to 300 per cent. on the capital. The Galway fisheries, belonging to the late Mr. Ashworth, are another striking instance of the same kind.

As every dam or weir is more or less differently situated as to circumstances affecting the passage of salmon, and no hard-and-fast rule can therefore be laid down as to construction of ladders, &c., it should be provided that no ladder or pass should be constructed until plans had been laid before and approved by the inspector, and that it should be constructed at his sight and to his satisfaction, or that of some person delegated by him for the purpose. This would avoid the possibility of placing ladders in wrong places, and other mistakes which have been common. It should be clearly laid down who is to place, pay for and maintain these passes, hecks at mill-lades, and other alterations on dams and obstructions. A bye-law should be made on the subject of obstructions other than mill-dams, &c., and compulsory power might be given to purchase, at so many years' purchase, all non-industrial obstructions presently existing by charter.

ANNUAL CLOSE TIME.

The hard-and-fast period of one hundred and sixty-eight days has not given universal satisfaction, though it may safely be said to work well on the whole. It, however, will admit of improvement in the way of elasticity. In some cases, at present, it is not enough, and in others it is more than enough. There are early rivers and late rivers, and it has been proved by actual experiment that the natural condition of these rivers cannot be altered, as is easily understood if, as is probable, Mr. Archibald Young's theory of temperature * be correct. The period ought to be made "not less than one hundred and sixty-eight days," as in Ireland, though a discretionary power might safely be left with the inspector to make it less in exceptional cases, after careful inquiry.

WEEKLY CLOSE TIME.

The weekly close time is too short; it should be extended to forty-eight hours. There is an almost universal consensus of opinion on this point. The amendment would act beneficially in more ways than one; it would allow more fish to get to the spawning beds, and it would still further enlist the protection of the upper proprietors by introducing more fish to their waters. The Irish close time is forty-eight hours, and the English was made forty-eight by the House of Commons, though reduced by the House of Lords to forty-two. It is well worthy of consideration, also, whether the whole period of forty-eight hours should not be made to commence at different times in the upper and lower netting portions of rivers. It seems of little use to let fish pass one series of nets if they are to be caught in another series higher up, because they have not had time to get further. This plan, which goes by the name of a "double slap," has received the approval of several experienced fishers.

POACHING.

Sufficient poaching clauses should be introduced into any new Act, with penalties which shall act as deterrents.

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* See Scottish Meteorological Journal, 1879, p. 258. "Sea and Salmon Fisheries" (British Industry Series), p. 218.

Poaching goes on in many districts at present with impunity, notably on the Tweed and on the west coast of Argyllshire. When committed in close time the penalties should be cumulative—both for fishing without a title, and for fishing in close time. Power should be given to watchers and police to stop and search all suspicious persons, and everything belonging to them, wherever found, without a warrant, and, if fish is found in their possession, they should be held guilty of contravening the Act, unless they can prove that they came by the fish legally. It is thought this would be an improvement on the 25th section of the Act of 1868. The impunity with which poachers are allowed openly to carry on their practices on the Tweed is equalled, if not surpassed, in the case of the "scringers" on the west coast of Argyllshire. Seeing that there is so much difficulty in catching these people in the act, other methods must be adopted, as, although the law has made what would appear sufficient provision for dealing with the offence, it seems to have proved of little use. What is necessary, is some plan to prevent the disposal of the fish, which at present seems as easy as in the case of fish legally taken. If every box or package of salmon entered for transmission at a railway station or harbour had to have an official permit or brand affixed to it, without which confiscation by the railway or harbour officials would be compulsory; and if no unpacked salmon were allowed to be sold at any quay, or to any person without the production by the seller of a licence by the chief constable or district board, showing that he was legally entitled to fish salmon—the buyer to be punished equally with the seller for breach of this regulation—a sensible diminution of the reprehensible practice would soon be effected, at least in the more serious cases. If a compulsory registration of all owners and tacksmen of fishings were enacted, this plan would simply be an offshoot of that system, and it would not be found difficult to carry out in practice. Poachers are almost always well known to the watchers and police, and special attention could be paid to their movements. Any legal dealer who might be disposed to assist the poachers might be subjected to such a heavy penalty as not to make it worth his while to run the risk. Adopt what precautions one may, however, the law will be evaded in some cases, but the risk of detection and the severity of punishment can at any rate be augmented. The absence of district boards in so many districts of course tends to leave poachers in comparative freedom, but the appointment of an inspector may of itself be expected to yield some result for the better, while a reconstruction of the system on which boards are constituted, and the institution of licences instead of assessment as a means of obtaining funds, would probably secure the formation of these where now wanting. Under their government, combined with increased facilities afforded for the co-operation of the police, the poachers would soon find it a little more difficult to carry on their nefarious practices.

It is difficult to see why there should be any difference in the law relating to poaching salmon and that relating to poaching game. Yet there is a great difference. The latter offence is punished by three months' imprisonment without the option of a fine, which may be increased on failing to find caution, and, on a third offence, five or seven years' penal servitude must be given. For salmon poaching, on the contrary, a fine of ten shillings may be imposed, and can never be increased to more than five pounds, though increased twenty times. Imprisonment is only *competent* (for three months) for night poaching by three or more persons, under the twenty-seventh section of the Act of 1862. This section provides, also, that failure to pay the fine shall be punished by imprisonment not exceeding three months, while the next section gives power to imprison for a period not exceeding six months, in default of payment of all penalties and expenses incurred under the Act, which, of course, includes the penalty under the previous section. The two sections are plainly inconsistent with each other on this point, and if the former rules as to the penalty for night poaching, it follows that if the fines for all minor offences be not paid, the offender can be imprisoned for six months; but a night poacher can only be imprisoned for three months in the same circumstances. A supplementary penalty for each fish caught by night-poachers should also be added, as in other cases of illegal fishing.

LICENCES.

The system of licences, which has already worked so well both in England and Ireland, can only receive a passing reference. The licences in Ireland vary from £1 to £30, the minimum licence for rods having been raised in all districts in 1870 from 10*s.* to £1. In England they run as low as 2*s.* or 3*s.* for rods, and £1 for fifty "putchers," to £20. In the latter country the total amount of licence-duty raised in the forty four districts in 1879 was £7176 1*s.*; in 1880, £7934 7*s.* 6*d.*; and in 1881, £7411 19*s.* 8*d.* From this it may be seen what might be done in Scotland were this system adopted. The system of assessment is not satisfactory, and it is hopeless to expect subscriptions or urchase the removal of cruives and obstructions.

MISCELLANEOUS SUGGESTIONS.

The proviso appended to section 6 of the 1862 Act, which has caused great confusion and doubt as to the powers of the Commissioners to make any effective regulations whatever, should be struck out or made intelligible; the sale, as well as the exportation (provided for by 1868 Act, section 22) of fish caught by rod during the net close time should be prohibited, and when salmon are sold or exported after close time has commenced in any district, though not in others, the onus should be laid on the seller or exporter of proving that they were caught in an open district. Persons who may catch diseased fish should be empowered, or rather ordered to destroy or bury them instead of returning them to the water, and it should be permitted to take salmon, as well as smolts and fry, for propagating purposes, in close time, with leave of the owner. A minimum penalty should be fixed, as well as a maximum, and one-fourth of the maximum has been suggested. "Parr" should be included *nominatim* with smolts and salmon fry in the 1868 Act, section 19. The Commissioners' bye-laws should be revised, and clerical errors corrected, such as "island" for "sound,"* "south" for "north,"† "river" for "rivers,"‡ &c.; and the words "of the net" should be added after "top to bottom," in the first section of the bye-law as to weekly close time; the river Eden, which falls into the sea within the limits of the Tay district, but which is excluded on the principle

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* "Stron Beg" (Spyon Beg?) "in the Sound of Mull." See under Loch Sunart in Limits of District.

† "A straight line drawn due north." See Kyle of Sutherland in Limits of Estuary.

‡ See under Tay—Limits of District.

"*Expressio unius est exclusio alterius*," should be included in that district. With reference to this, however, it is worthy of serious consideration whether the prohibition should not be directed against catching fish under 6 or 7 inches in length, instead of against catching parr or salmon fry. Many rod-fishers are ignorant of the difference between parr and trout, and others contend that the parr is not the young of the salmon, notwithstanding the apparently ample proof to the contrary.

"Fixed engines" should be defined, as is done both in the English and Tweed Acts, and the provision of those Acts which prohibits using draught or wear shot nets within a certain distance of each other, until the one adjoining is fully landed, should be adopted. The distance in the Tweed Act is only thirty yards, but in the English Act it is one hundred yards, which is preferable. Over fishing by net and coble has become a serious evil in some rivers, and there is good ground for believing that, were it not for the weekly close time, not a single fish would ever reach the upper waters.

The question of land drainage and storage of water seems, at present at least, not within the province of legislation; nor is the important subject of artificial propagation, though power might be given to district boards to apply certain portions of the income received from licences, if introduced, towards the establishment of breeding-ponds. It seems also worthy the consideration of proprietors of fishings, whether arrangements could not be made to work the fishings jointly, so as to save much of the expense at present incurred, on a plan on the lines of that suggested by the late Mr. Alexander Russel in the *Edinburgh Review* for 1851, and subsequently enlarged upon in his book on the salmon. Joint arrangements have been carried out successfully in some instances already, *e.g.* in the Nether Don fishings in Aberdeenshire, and on the Tweed.

THE TWEED.

The Tweed.

The Tweed has a course of 100 miles, and a drainage area of 1870 square miles, and was at one time the most productive salmon river in Scotland, though it has long fallen from this high estate, forming now a bad second to the Tay. Owing to its exceptional position as being situated partly in England and partly in Scotland, the Tweed has always been the subject of special legislation. Before the time of James I. its position was very unfortunate, as, in common with the Solway, little or no protection could be secured for it, owing to the jealousy between the two countries. It is not altogether clear that the old Scotch statutes applied to the Tweed, but the presumption is that they did for the most part. However, this question does not require to be considered, as the precaution was taken in the case of the Tweed, which was omitted in the general Scotch Act, though passed five years later—viz. to repeal all prior statutes—and, therefore, we do not require to go further back than 1857 in our examination of the law relating to the river. The law is contained in the two Tweed Acts of 1857 and 1859, together with occasional sections in the general Scotch Acts, which are declared to apply to the Tweed also.

The Act of 1857 is in many respects superior as a general measure to the subsequent Scotch Act of 1862, and might with advantage have been taken as a closer model. Curiously enough, it was the outcome chiefly of an agitation about fixed nets promoted by the upper proprietors, headed by the Duke of Roxburgh, and adopted by the Tweed Commissioners.

The Tweed.

The Tweed Fisheries Amendment Act of 1859 is appointed to be read along with the Act of 1857, several sections of which it repeals and re-enacts. Its chief object was to alter the close time fixed by the Act of 1857, which was found to be too late in commencing, though it makes some minor improvements which had been shown to be necessary, and it introduces a tidal close time for stake- and bag-nets, and makes regulations to be observed in the use of these.

The two Acts, taken together, provide for the appointment of Commissioners, with certain qualifications, to administer the law, and for the appointment of water bailiffs and others to prevent and detect offences; make provision for collection of rates and assessments, fix extended limits of the mouth of the river; fix annual and weekly close times; prohibit fixed nets and fixed engines (except within the extended limits of the entrance), the use of the leister, and pollutions; make regulations as to mill-dams and caulds, hecks in mill-lades, wear shot nets, stake- and bag-nets, and the management of joint fisheries; order the removal of natural obstructions and cairns; and contain similar provisions with the general Acts relating to the observance of the close times; detection and punishment of offences; with specification of penalties and general regulations.

In addition to its situation in two countries, the Tweed is peculiar in possessing no natural estuary, and therefore, if netting at the mouth were not restricted, almost every fish might be intercepted in its passage into the river. The limits of the mouth have consequently for a long period been extended by the Legislature to compensate for the want of an estuary, and not only is the entrance widened on each side of the river, but the river itself is, as it were, extended for five miles straight out into the sea. **The Tweed.** This last extension has been productive of some dissatisfaction among the fishermen, owing to the rule of international law fixing three miles as the limits of British waters, the result of course being that the outermost two miles are open to foreign fishermen, while they are forbidden to our own. The deprivation, however, is not of great importance, and it is worthy of notice that the regulation in question has been repeated in every Act passed since the first, almost a century ago, and also that the Special Commissioners appointed in 1875 to enquire into the operation of the Tweed Acts, after due enquiry, did not think it necessary to advise any alteration.

CLOSE TIME.

The annual close time in the Tweed extends only to 154 days, the same as in England. Although it does not appear that the majority of proprietors wish for any alteration of this period, it was recommended by the Commissioners of 1875 that it be extended to 167 days, that is, from 14th September to 15th February, at which it is now fixed, to from 15th September to 28th February, both inclusive, for nets, and for rods that it should be altered to 15th November to 28th February, both inclusive, the present period being 30th November to 1st February.

No change of the weekly close time (36 hours) is recommended by the Commissioners, though we do not see why the benefit which would be derived should not be as great as it has proved in the case of Scotland generally. They, however, recommend the "double slap," alluded to at p. 533. The weekly close time at present extends from six o'clock on Saturday evening to six o'clock on Monday morning.

The Tweed.

FIXED NETS.

Previous to 1857 several species of fixed nets were in use in the Tweed, of which the most deadly was the "stell net," chiefly used by the lower proprietors, while the upper proprietors possessed the "cairn-net."

As we have already indicated, the upper proprietors commenced an agitation for the withdrawal of the fixed nets in the lower waters, offering at the same time to give up their own, but as no compromise could be effected, the upper proprietors took the matter to Parliament in the shape of the Bill of 1857. After a bitter fight, the object was gained, and fixed nets in the Tweed, as in the rest of the rivers and estuaries of Scotland, are now a thing of the past. In this litigation all the arguments which could possibly be urged on behalf of fixed nets were forcibly set forth, including melancholy pictures of the ruin which would ensue to some of the proprietors, and the robbery of widows and children. Notwithstanding all this, the Legislature was convinced that the fixed nets were both injurious to the fisheries and adverse to the spirit of the law, and abolished them without any compensation. What has been the result? Not ruin, certainly, either to the fisheries or to the proprietors. The rental was in 1857 £4920. In 1858 it had fallen to £4705, but it immediately recovered itself even at the portions of the river where the stell net had been used, and since then it has gradually increased to £11,224 in 1874, £12,173 in 1875, and £12,287 in 1876, while it is probably now not less than £14,000 or £15,000.*

Stake-nets and bag-nets are, however, still allowed in the portions of the entrance to the river situated between the

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* The latest statistics have not come to hand.

The Tweed.

extended limits fixed by the Act of 1857 (five miles south and four miles north along the coast, and five miles out to sea), and the limits as further extended, first by the Act of 1859, and again by bye-law of the Scotch Commissioners, dated 10th August, 1863. They are subject to certain regulations specified in the Act of 1859, principally relating to the observance of the close times, but there is no limit on the length of the nets or on the length and height of the leaders. Restrictions on these points should be applied as suggested with regard to the coast generally, and the junction of stake- and bag-nets should be forbidden here also.

The remarks already made, however, as to the total abolition of fixed nets apply to those on the Tweed also, although in this case the matter is less important apart from principle, seeing that the distance which the nets are obliged to keep from the river prevent their doing any serious injury to the fishings. The inconsistency which is such a difficulty in the Solway still remains, however. These nets are allowed along the coast of Cumberland, while a little further on the English law applies which forbids fixed nets entirely.

MILL-DAMS, &C.

Section 56 of the Act of 1857 contains regulations as to the construction of mill-dams, weirs, caulds, &c. All such erected after passing of the Act are to afford a free run for the fish, and those existing at that time are to be altered for this purpose. There is a clause, however, providing that the height of any mill-dam, &c., is not to be lowered in any part in making these alterations. The effect of this is in great measure to nullify the benefit of e Tweed. the enactment. The best way to provide a free passage for the salmon is undoubtedly to lower the dam at some portion, which can generally be done without any serious loss of water for mill purposes. The only alternative is to construct a salmon ladder or pass, and if the dam is too steep, it may be difficult to get a sufficiently easy gradient without lowering the height.

The proprietors above any cauld, &c., should have power to apply to the Commissioners to remove or improve it on guaranteeing the expense, if that cannot be laid on the proprietor.

The Special Commissioners of 1875 report that there is no serious obstruction from Berwick-on-Tweed to the spawning grounds, except Tweedmill cauld, which should be bought, and either altogether removed or so improved as to obviate objection to it. The regulations applicable to Scotland generally under the bye-law (G) of the Commissioners with regard to hecks in mill-lades are preferable to the regulations contained in section 59 of the Tweed Act of 1857, and should be substituted for this section. The whole bye-law might with advantage be applied to the Tweed. This alteration would also provide against the undue abstraction of water by mill-lades, upon which there is no check in the Tweed Acts.

POLLUTIONS.

The remarks and suggestions made on pollutions and poaching in a former part of this paper, with regard to Scotland generally, apply with even more force to the Tweed, which is unquestionably the most persistently and extensively poached and polluted river in the kingdom. It is therefore unnecessary to enter fully into the subject

The Tweed.

again. The Pollution Clauses in the Tweed Act are, however, even less efficacious than those in the general Acts, as it must be proved that the fish were actually killed or poisoned by the noxious matter. The words should be "poisonous or deleterious to salmon." The recently instituted action by the riparian proprietors against the Galashiels manufacturers may be expected to result in the earnest though non-spontaneous efforts of the latter to overcome the difficulty, and if they will only cordially co-operate with each other for this purpose instead of for that of resisting the generally weaker associations (as regards funds) of the riparian proprietors, we do not despair of very shortly witnessing a marked improvement both in the fishings and in the salubrity of the district. At all events they will have the consolation that the money was better spent. A conjoint purification work might easily be erected and kept going at comparatively little expense to each manufacturer, when divided among the whole. But the expense is not a necessary consideration. It seems a little inconsistent that manufacturers should for so long a time have been compelled to consume their own smoke or render it harmless by carrying it to great heights by means of enormous and costly chimneys, while they should have been permitted to commit at least as great a nuisance by making sewers of the rivers. It is surely as much of an offence from any point of view to poison the water as to poison the air.

POACHING.

With regard to poaching, the Special Commissioners of 1875 seemed to be inclined to recommend a little less severity, a view with which, however, we are unable to

The Tweed.

agree. When the feeling of the people in the district on the question of the right to salmon is taken into consideration, it must be seen to be hopeless ever to expect any voluntary assistance from them, and the only remedy is to be found in force. In proof of this may be mentioned the fact ascertained by the Special Commissioners, that the parts of the river which were most poached were precisely those which the proprietors had been liberal enough to throw open to the public for fair rod-fishing. The sympathy of nearly every person seems unfortunately to be with the poachers, and it is discouraging to believe that persons in respectable positions are often aware of the possession by a poacher of a large number of illegally captured salmon without thinking of giving information to the police or bailiffs. Every person who can be proved to have known of the capture or possession of poached fish by any individual, should himself be made liable in the same penalties, as guilty "art and part" with the poachers. If some means of protection were devised by which the names of persons giving information need not be divulged, some assistance might perhaps be obtained from this source. Purchase of salmon taken during close time, as well as poached during open season, should be punishable the same as sale or possession. There might be sale and purchase without possession by the purchaser.

The difference between the Tweed and the Tay with regard to poaching is very striking. In the latter district the popular sympathies are rather in favour of the law than against it, and the result is seen in the small cost of protection compared with the Tweed, and it no doubt has its effect on the rental likewise. The cost of protection on the Tweed is over £2000 per annum, and seems likely to increase, while on the Tay it is less than £1000, and the

The Twee

rental of the latter is £6000 or £7000 greater than that of the Tweed. Again, the proprietors on the Tweed have assessed themselves voluntarily to 7 per cent. more than they are compelled to by the statutes, or 27 per cent., and they wish power (which should be granted) to increase the assessment to 30 per cent., while on the Tay the assessment is under 10 per cent., and the number of prosecutions less than one-sixth.

In 1875 the Special Commissioners remarked that the average annual prosecutions on the Tweed were 271, greater than the whole number for England and Wales (266). This comparison hardly holds now, however. The figures 266 were for a low year (1873). In 1880 they were 807 (645 convictions) and in 1881, 604 (501 convictions). The Tweed can scarcely have increased to this extent.

The general poaching Acts should be made clearly to apply to the Tweed, as well as to Scotland.

Poaching in close time should be punished with the cumulative penalties, that for contravening the close time, and that for poaching alone. The word "cart" contained in section 10 of the 1859 Act should be included in section 70 of the 1857 Act as to seizing of unseasonable fish and the receptacles containing them.

MISCELLANEOUS.

The proviso as to wear shot nets should be amended, making the distance between them greater. Thirty yards seems too little to be of much effect. In England the distance must be one hundred yards.

The Commissioners should obtain power to stake the river so as to prevent illegal netting, which is prevalent in the upper waters. It should be made unlawful to take

The Tweed.

smolts and parr at any time by rod and line, and not only during the period between 1st April and 1st June, and, as before suggested, a limit of length, say six inches, should be added instead of the word "parr."

The use of the gaff is prohibited to anglers when spent fish are in the river. To this prohibition should be added minnow tackle, which is just as likely to cause fatal injuries as the gaff. Killing of "baggits" should also be forbidden. It might, perhaps, be better to alter section 82 of the Act of 1857 in conformity with the law applicable to Scotland generally, which is, that persons cannot be convicted of offences in absence without proof in the same manner as if they were present. As a general rule, non-appearance is held as confession, but the alteration would at least leave no ground of complaint.

Sections 25 and 26 of the Scotch Act of 1868 should be extended to the Tweed so as to give power to search baskets and creels or other receptacles of fishers.

Section 39 of the 1857 Act should be amended so as to afford no room for doubt that the fine is exigible for resisting a private person acting in execution of the Act.

The penalty of £20 imposed by section 73 for catching salmon, &c., while fishing for trout, is out of all proportion to the offence, compared with the penalties for other much worse offences. The enactment ought also to be altered so as to provide for the returning to the water or delivering to the nearest bailiff or constable, any salmon so caught, instead of binding him to deliver it to the proprietor. It is hard for any one who may catch a salmon by accident to know where the proprietor may be, or even who he may be, and if he did know, to require him to go to such personal inconvenience as this rule might entail.

It is deserving of consideration whether respectable

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fishermen should not be granted a license to possess nets for use in white fishery, so as to exempt them from the stringent provisions of section 51 of 1857 against the possession of nets, &c., which might be used in contravention of the Act.

Section 76 of the 1857 Act declares the Fresh Water Fisheries Act of 1845 to apply to the whole of the river. The Fresh Water Fisheries Amendment Act of 1860 should also be made to apply to the whole of the river, as at present it only applies to the part in Scotland. Licenses for rods might also be introduced on the Tweed, and the Special Commissioners suggested £1 for the river below Walkerburn, and 10*s.* above. The licensing system might, however, be carried still further, and would afford a means of relieving the proprietors of some portion at least of the heavy assessment with which they are burdened.

There are several other points of less general importance which might advantageously be adopted in the Tweed legislation. For most of these, and for very valuable information on the whole subject of the fisheries in the district, reference is made to the Report already alluded to, by the Special Commissioners of 1875. We do not, however, altogether agree with some of the recommendations in the Report, which seem to be of doubtful expediency, but refrain from discussing them.

In conclusion, it is a matter for great regret that one result of the opposition which the recent Fishery Board Act met with in Parliament from certain parties was the exclusion of the River Tweed from the application of the Act, so that the river is denied the chance of sharing in the immense benefit which may confidently be expected to accrue from the appointment of an Inspector of Salmon Fisheries for Scotland.

The Solway.

THE SOLWAY.

The history of the law relating to the Solway Firth is a very complicated one, and no purpose would be served by entering into it here.

There are still several old Scotch Acts which must be referred to in ascertaining the law on some points, but the Act which now regulates the Scotch portion of the Solway (except the Annan and the Esk) is the Act of 1804, 45 Geo. III., c. 45. There are also the Annan Acts, the English Acts of 1861 and 1865, and the Scotch Acts of 1862 and 1868.

Within the limits of the Firth, as at present fixed, are included the estuaries of about ten English rivers, eight Scotch rivers, and one partly Scotch and partly English. These limits are, however, far too wide, and were fixed under a mistake, as shown in the Report after referred to.

The Solway Act of 1804 legislated for the fisheries on both sides of the Firth. It fixed the limits to be that portion of the Firth east of a line drawn from Skinberness, in Cumberland, to Carsethorn of Arbigland in Kirkcudbright, and within a line drawn from thence two miles seaward along the coast to Mull of Galloway on one side, and Hodbarrow Point in Cumberland on the other.* It fixed a close season, and made stringent regulations for its observance, and against illegal modes of fishing, and generally provided for the regulation of the fisheries. The English Act of 1861, however, repealed the Solway Act so far as it related to England, and made certain enactments in place of it. The Scotch Act of 1862 did not follow this example, but declared the provisions of the English Act, with regard to fixed engines, to be applicable to the Scotch side of the Solway. The result of this was that the Act of 1804 applies to the Scotch shore of the Solway and not to the English, while the English law of fixed engines was attempted to be introduced into Scotland, without effect, however. The Commissioners under the Scotch Act were empowered to fix the limits of the Firth anew, which they did, in accordance with those first above mentioned. They also fixed the close seasons for the Scotch rivers.

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* See map attached to Solway Report, by Messrs. Young and Walpole, November 30, 1880.

The Solw

The English Act of 1865 placed the Esk under English law, but the Scotch portions of it remained under the Solway Act.

Thus there were several contradictory and inconsistent regulations brought into force on the two sides of the Firth. There was one annual close season, and one weekly close season on one side, and another annual and weekly close season on the other. A mesh of net eight inches round was fixed in England, while seven inches was the minimum allowed in Scotland.

But perhaps the greatest anomaly occurred in connection with fixed engines. It was decided that all the fixed engines on the English side were illegal, and they were therefore abolished. On the other hand, it was found that the fixed engines on the Scotch side could not be interfered with, and the 33rd section of the Scotch Act of 1862, importing the law of England as to fixed engines into Scotland, became inoperative.

The Scotch Act of 1563 had exempted the Solway from the effect of previous Acts declaring the illegality of fixed engines "where the sea ebbs and flows," and but for this exemption all such engines would have been illegal, as they are in every other estuary. It is only natural that the fishermen on the English side should look upon this as an

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unfair distinction, and a state of enmity be produced between the fishermen on the two sides, very much analogous to that which existed between their ancestors, and was the cause of the exemption which has given rise to the whole difficulty.

To quote the report of the Solway Commissioners, dated the 30th of November, 1880:—"The legislation initiated in 1861 for the regulation of the fisheries had produced four anomalies, which were especially perceptible in that part of the Firth, where it is a narrow channel fordable by the fishermen at low water. (1.) On the English side of the Channel the annual close season commenced on the 1st of September, and terminated on the 2nd of February. On the Scotch side it commenced on the 27th of August, and terminated on the 10th of February. (2.) On the English side the weekly close season commenced at noon on Saturday, and continued till 6 A.M. on Monday; on the Scotch side the weekly close season commenced at 6 P.M. on Saturday, and terminated at 6 A.M. on Monday. (3.) On the English side every net with a mesh of less than two inches from knot to knot was illegal; on the Scotch side every net with a mesh of less than one and three quarter inches from knot to knot was illegal. (4.) On the Scotch side fixed engines were left standing; on the English side they were removed."

Subsequent inquiries have shown the impossibility of abolishing the stake-nets on the Scotch side without compensation, and matters now remain in the unsatisfactory state above indicated.

The limits of the Firth now existing were, as shown in the appendix to the above-mentioned Report, fixed in error, and there was no authority whatever for adhibiting Mr. Leslie's name to the bye-law fixing those limits. A majority of the Commissioners (Messrs. Ffennell and Leslie) fixed, in

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1864, what seemed to be the natural *fauces terræ*, from Ross Head Lighthouse, in Kirkcudbright Bay, to Great Bees Head, but the other, Mr. Eden, somehow or other carried his point. The limits as now existing are simply absurd.

Messrs. Walpole and Young recommend the old line (in the Act of 1804) from Skinberness to Carsethorn on the western boundary of the Firth, but they add an eastern boundary, and do away with the two-mile limit along the coast. As the fixing of the limits of estuaries, however, had only reference to the illegality of fixed nets, it is difficult to see what purpose is served by the fixing of the limits of the Solway west of the east boundary, at any rate, seeing that the nets there cannot be touched.

We cannot do better than quote from the Solway report, the summary of the recommendations of the Commissioners with regard to the most important points :—

I. "The Acts relating to the Solway, *i.e.*, the Solway Act, 44 Geo. III., c. 45, and the Annan Act, 4 Vict., c. 18, should be repealed.

II. "The limits of the Solway for salmon fishery purposes should include all that arm of the sea which is situated between Scotland and England, and which lies east of a line drawn from the large house at Carsethorn in Arbigland, in the Stewartry of Kirkcudbright, to the hotel at Skinberness, in the parish of Abbey Holme in the county of Cumberland, and west of a line drawn from the west bank of the water of Sark at Sark foot in the county of Dumfries, to Burgh Head in the county of Cumberland. Within the aforesaid limits the Solway Firth should include the sea and the rivers so far as the tide flows and ebbs.

III. "Outside these limits :—

(*a.*) All the rivers which are entirely Scotch should be placed under the Scotch laws.

Solway.

(*b.*) All the rivers which are entirely English should be placed under the English laws.

(*c.*) The Esk, which is partly Scotch and partly English, should continue under the English law, administered by Scotch Courts as regards the portion of the Esk in Scotland, and the Scotch Acts so far as it is concerned should be expressly repealed.

IV. "Inside these limits:—

(*a.*) The annual close season should commence on the 10th of September, and continue till the 15th of March, both inclusive.

(*b.*) The weekly close season should commence at the low water next after 6 A.M. on Saturday, and continue for four complete tides.

(*c.*) The mesh for taking salmon should be not less than 1¾ inches from knot to knot, or 7 inches round."

The Commissioners add certain other recommendations as to whammel and paiddle nets, with reference to the former of which they suggest that the exact boundary between England and Scotland in the estuary should be marked out by buoys. Those whammel nets are often 600 to 800 yards long, and therefore extend quite to the Scotch shore, which creates as great a grievance to the Scotch fishermen as the stake-nets do to the English. The boundary would keep them in their own ground.*

It is suggested that the 25th section of the Scotch Act of 1868, with reference to powers of search for illegally captured fish to watchers, &c., should be extended to the Solway; that the 9th section of the Solway Act, prohibiting unqualified persons from fishing in private waters, should be amended, and that trustees should be appointed.

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* These whammel nets were recently the subject of prosecution, and it is believed they were decided to be illegal.

The Solway.

with power to raise funds to purchase the fixed nets on the Scotch shore of the Solway.

Most of the rivers in the Solway have generally been subject to special legislation. The Esk is now under English law, but it would seem that the Solway Act still applies to the Scotch portions of it, as well as the English Act. The Firth is now under the general Scotch Acts. The Annan is also under the general Scotch Acts, but it has also an Act of its own still in force, the Annan Act, 1841. There is nothing, however, which calls for any special notice.

The Report by Messrs. Walpole and Young is so recent, and deals so ably and fully with the whole question, that it cannot be improved upon, and we therefore content ourselves with referring to it.

If the fixed nets could be got rid of on the Solway, the fishings must materially improve. The gross annual value of the fish caught at present is probably not less than £7000 to £8000. Here is what Russell says about the Newbie fishings :—*

> "The Solway also affords the most conclusive evidence not only of the unfair, but of the ultimately self-destructive operations of these engines. The first stake-net on the Solway—*i.e.* the first fixed net with leaders and chambers—was erected at a place called Newby, a short distance west of the mouth of the Annan, in 1788. Up to that time the rent of the Newby fishery had been only £16, whilst the rents of the fisheries farther up the Firth amounted to several hundreds of pounds. In a few years the rent of the Newby fishery, formerly £16, was £2000! whilst its upper neighbours sank to a mere fraction of their former value. Here was a great transfer of property, and then came a great destruction of property. The Newby example was copied; the Firth was overfished; the rent of Newby is now (1864) little more than a tenth of what it was; and its neighbours, though they did not participate in its prosperity, have shared in its decay: for instance, a

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* Russell 'On the Salmon,' p. 131.

fishery which used to yield the Corporation of Carlisle a rent of £722 when salmon sold at 2*d.* a pound, now yields a rent of only £55 when salmon sells at as many shillings a pound. In a word, the "improved engines" have not only reduced the total produce of the Firth and its rivers, but have reduced the total money value far below the amount at which it stood, when ten tons of the produce brought no more money than one ton brings now."

CONCLUSION.

In conclusion we think it may be stated without risk of challenge, that the number of salmon caught in the rivers of Scotland has very greatly decreased during the present century, for causes which are to a great extent remediable.

That, notwithstanding the combination of so many enemies to its existence, the salmon is still to be found in anything like numbers, is a fact for which we can claim little credit, and it behoves us now anxiously to bestir ourselves to undo the mischief that has been done. When we have reached that point it will be time to go further.

The following figures may be interesting, as showing the fluctuations in the number of boxes of salmon sent to Billingsgate from Scotland during the last twenty years, since the passing of the Act of 1862.

1863	24,297	1868	28,020	1873	30,181	1878	27,660
1864	22,603	1869	20,474	1874	32,180	1879	15,564
1865	19,009	1870	20,648	1875	20,375	1880	17,408
1866	21,725	1871	23,390	1876	25,645	1881	23,817
1867	23,006	1872	24,404	1877	29,366	1882	22,968
	110,640		116,936		137,747		107,417
Average	22,128	Average	23,387	Average	27,549	Average	21,483

(Exclusive of Berwick-on-Tweed from 1874, not distinguished before.)

The average of the last period is thus less than the first. Though they serve, to a certain extent, as an indication, these statistics must not be too implicitly relied on, as they may lead to fallacious results. It is impossible to ascertain what quantities of fish were disposed of otherwise.

It is probably unnecessary to direct the attention of those interested in the Scotch salmon fishings to the reports of the recently constituted Scotch Fisheries Improvement Association, of which they have now published three, all containing valuable information relating to the subject. The first report (May, 1881) is more especially instructive to those interested in reform, as containing many important details collected from various reliable sources, showing the condition of deterioration and disorganisation into which salmon fishery matters have fallen in Scotland. It has been ascertained (1), that there are seven counties in Scotland with thirty-two rivers which have ceased to be frequented by salmon, owing first to dams built across the rivers, which prevent the fish getting up to spawn ; and secondly, to manifold pollutions from town sewage, bleach-fields, chemical works, and other manufactures.

(2) That in eight counties with salmon rivers there are no District Boards.

(3) That in one of these counties (viz., Ross and Cromarty) there are no less than thirty-two salmon rivers without official protection.

(4) That in Argyllshire, where there are also about thirty salmon rivers, there is only one District Board, whose place of meeting is in the Island of Mull.

We commend these statistics to the anxious study of all concerned.

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